Cedar Grove School District

Cedar Grove, NJ

2016 | CGHS

Pre-Calculus Honors

Approved by the Cedar Grove Board of Education

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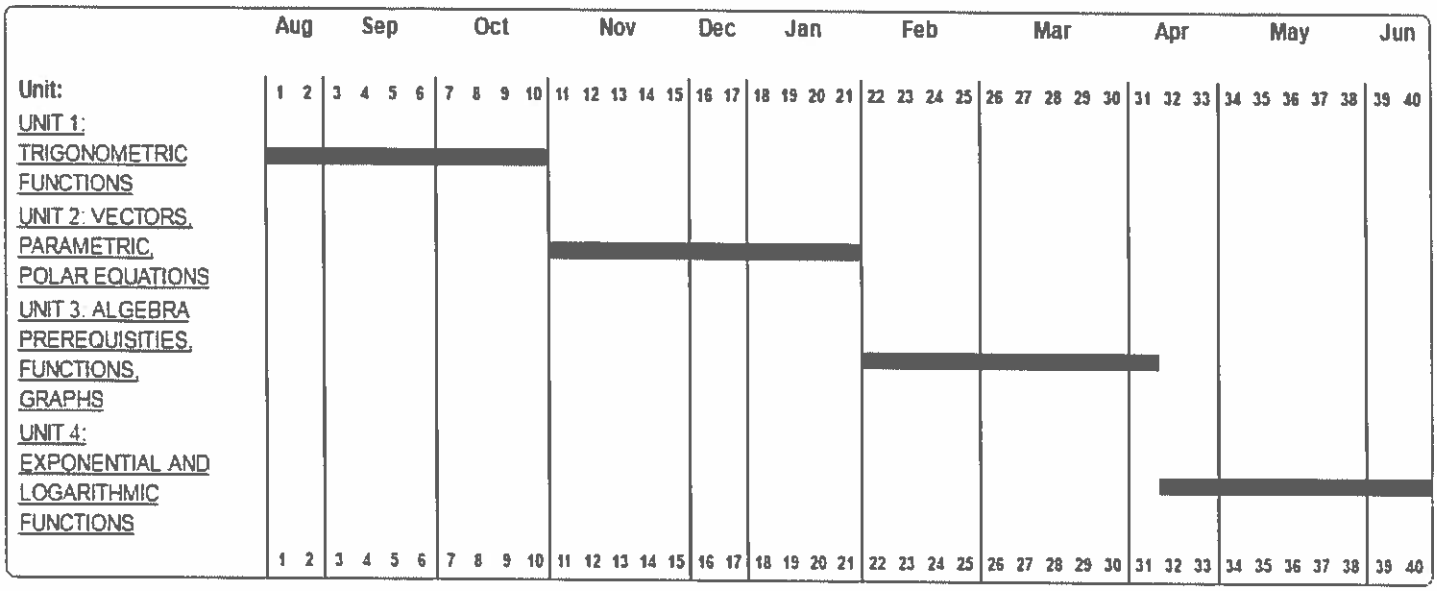
Pre-Calculus Honors
Course Description

This course is the third course offered in the math honors sequential program and is for students who have shown a superior mathematical aptitude. Emphasis will be on selected topics of an advanced mathematical nature in preparation for calculus. Topics include, but are not limited to, trigonometry, polynomial, power and rational functions, analytical geometry, systems of equations and inequalities, matrices, logarithms, math induction, polar coordinates and vectors, limits of polynomial functions, complex numbers, and parametric equations. Emphasis will be placed on solving real world problems both by pencil and paper methods and by the use of graphing calculators.

Prerequisite: Algebra II Honors

Pre-Calculus Honors

Course Calendar



Unit Planner: UNIT 1: TRIGONOMETRIC FUNCTIONS
Pre-Calculus Honors

Tuesday, September 6, 2016, 11:39AM

Cedar Grove High School > 2016-2017 > High School > Mathematics > PreCalculus Honors (D) > Week 1 - Week 10

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.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

HSF-TF.A.2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

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

HSF-TF.A.4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

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.

HSF-TF.C. Prove and apply trigonometric identities.

HSF-TF.C.8. Prove the Pythagorean identity $\sin^2(?) + \cos^2(?) = 1$ and use it to calculate trigonometric ratios.

HSF-TF.C.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Enduring Understandings

1. There are special relationships between the sides and angles in a triangle.
2. Right triangle trigonometry can be used to solve real world problems.
3. Angles can be measured in both degrees and radians.
4. The unit circle can be used to find the values of sin, cos, and tan.
5. Graphs of sin, cos, and tan and their inverses can be changed using the period, amplitude, and phase shifts.
6. Real world problems can be modeled using trigonometric graphs.
7. Trigonometric equations can be solved algebraically and graphically.
8. Trigonometric identities can be used to simplify an expression and solve an equation.
9. Trigonometry can be used to find the area of a

Essential Questions

1. How are the sides and angles of triangles related?
2. How are the three trigonometric functions used in the real world?
3. How do the values of the unit circle apply to the graphs of sin, cos, tan?
4. How can we simplify an expression using trigonometric identities?
5. How can we use trigonometric identities to solve trig equations?
6. How can we solve for missing pieces of a triangle that is not a right triangle?

triangle.

Content	Skills
1. Bearing of an object 2. Radian and degree measure 3. Arc length formula 4. Angular speed 5. Trig functions 6. Two special triangle ratios 7. Value of trig functions with a calculator 8. Right triangle trigonometry 9. Coterminal angles 10. Period of a function 12. Amplitude and period of a curve and phase shifts	1. Find the bearing of an object 2. Convert between radian and degree measure 3. Apply arc length formula 4. Use angular speed in real life problems 5. Define the six trig functions 6. Apply the two special triangle ratios 7. Evaluate trig functions with a calculator 8. Applications of right triangle trigonometry 9. Use coterminal angles to find measures of angles 10. Use a trig ratio to find other ratios 11. Understand and apply the period of a function 12. Understand and apply amplitude and period of a curve and phase shifts 13. Solve real world problems 14. Simplify trig expressions using identities 15. Solve trig equations using identities and factoring 16. Apply law of sines and cosines 17. Use sum/difference and double and half angle identities to solve equations 18. Apply Heron's formula

Stage 2: Assessment Evidence

Assessments

Daily problem of the day
Formative: Self Assessment
Quizzes
Formative: Self Assessment
Daily homework assignments
Formative: Self Assessment
Chapter tests
Summative: Standardized Test

Stage 3: Learning Plan

Learning Activities	Resources
1. Convert between degree and radian measure and calculate arc length of a circle. 2. Use arc length formula to determine a wheel's r.p.m. and m.p.h. 3. Find the bearing of an object. 4. Evaluate trigonometric functions with and without a calculator. 5. Solve real world problems using right triangle trigonometry. 6. Graph sin, cos, and tan functions with and without calculators. 7. Simplify trigonometric functions. 8. Find angles using sum/difference and multiple angle identities. 9. Apply the laws of sines and cosines in real world applications.	Text: Precalculus - Functions and Graphs Demana, Waits, Foley, Kennedy Addison Wesley

Unit Planner: UNIT 2: VECTORS, PARAMETRIC, POLAR EQUATIONS

Pre0Calculus Honors

Tuesday, September 6, 2016, 11:39AM

Cedar Grove High School > 2016-2017 > High School > Mathematics > PreCalculus Honors (D) > Week 11 - Week 21

Stage 1: Desired Results

NJ Standards

NJ: 2016 SLS: Mathematics

NJ: HS: Num/Quantity

Vector & Matrix Quantities

HSN-VM.A. Represent and model with vector quantities.

HSN-VM.A.1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v, |v|, ||v||, v).

HSN-VM.A.2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

HSN-VM.A.3. (+) Solve problems involving velocity and other quantities that can be represented by vectors.

HSN-VM.B. Perform operations on vectors.

HSN-VM.B.4. (+) Add and subtract vectors.

HSN-VM.B.4b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.

HSN-VM.B.5. (+) Multiply a vector by a scalar.

HSN-VM.B.5b. Compute the magnitude of a scalar multiple cv using ||cv|| = |c|v. Compute the direction of cv knowing that when |c|v ? 0, the direction of cv is either along v (for c > 0) or against v (for c < 0).

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.

Enduring Understandings

1. Vectors indicate both direction and magnitude.
2. Vectors can be used to solve motion and force problems.
3. Dot product of vectors can be used in various formulas from physics.
4. Graphs of parametric equations can be used to simulate motion.
5. Coordinates for a point can be converted between rectangular and polar forms.
6. Graphs of polar equations can model circular or cylindrical symmetry.

Essential Questions

1. How can vectors be used to represent force, velocity and acceleration?
2. How can we find the angle between vectors?
3. How can we simulate motion using parametric equations and a graphing calculator?
4. How are polar coordinates similar to vectors?
5. How do you graph polar equations?

Content

1. Vectors in the plane
2. Components of vectors
3. Direction Angles
4. Vector operations
5. Dot product of vectors
6. Eliminate a parameter
7. Parametric equations and motion
8. Polar coordinates
9. Graphs of polar equations

Skills

1. Put vectors into component form.
2. Perform operations with vectors.
3. Find an angle between 2 vectors.
4. Write velocity as a vector.
5. Understand and use properties of the dot product.
6. Convert a parametric equation into a linear equation.
7. Find and graph parametric equations.
8. Use parameric equations to simulate motion.
9. Plot points in the polar coordinate system.
10. Convert between rectangular and polar coordinates.
11. Analyze graphs of polar equations.

Stage 2: Assessment Evidence

Assessments

Daily problem of the day
Formative: Self Assessment
Daily homework assignments
Formative: Self Assessment
Quizzes
Formative: Self Assessment
Chapter tests
Summative: Self Assessment

Stage 3: Learning Plan

Learning Activities

1. Find a compass heading that a plane should follow and find ground speed taking wind velocity into account.
2. Find the amount of work done in moving an object from point A to point B.
3. Determine if a baseball will clear a fence in the outfield using parametric equations to simulate motion.
4. Find the distance between 2 planes using polar coordinates.

Resources

Text :
Precalculus - Functions and Graphs
Demana, Waits, Foley, Kennedy
Addison Wesley

Unit Planner: UNIT 3: ALGEBRA PREREQUISITIES, FUNCTIONS, GRAPHS
Pre-Calculus Honors

Tuesday, September 6, 2016, 11:39AM

Cedar Grove High School > 2016-2017 > High School > Mathematics > PreCalculus Honors (D) > Week 22 - Week 31

Stage 1: Desired Results

NJ Standards

NJ: 2016 SLS: Mathematics

NJ: HS: Num/Quantity

The Real Number System

HSN-RN.A. Extend the properties of exponents to rational exponents.

HSN-RN.A.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

HSN-RN.A.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents.

NJ: HS: Algebra

Arithmetic with Polynomials & Rational Functions

HSA-APR.A. Perform arithmetic operations on polynomials.

HSA-APR.A.1. Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

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

HSA-APR.B.2. Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).

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.

HSA-APR.C. Use polynomial identities to solve problems.

HSA-APR.C.5. (+) Know and apply the Binomial Theorem for the expansion of (x + y)n in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

HSA-APR.D. Rewrite rational expressions.

HSA-APR.D.6. Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.

Enduring Understandings

1. Exponential equations can model real world behaviors.
2. The equation of a circle is based on the distance formula.
3. Graphs of linear equations and inequalities indicate possible solutions for their domain and range.
4. Quadratic equations can be solved using a

Essential Questions

1. What steps are needed to accurately simplify algebraic expressions?
2. How are absolute value and distance related?
3. When graphing linear equations, what does the line of the graph represent?
4. What methods can we use to solve quadratic equations?
5. What is a function? What is it's inverse?

number of differentiated techniques.
5. Functions are mathematical expressions that can be added, subtracted, multiplied, and divided. The graphs of functions may translated, rotated, and reflected.
6. The graph of a function can be used to indicate it's domain and range as well as it's behavior over an extended range of values.
7. Inverse functions
8. Functions can be used to model real-world situations.

6. How can we modify a function to change it's position/orientation on the Cartesian plane?
7. What is a regression curve?

Content

- Exponential Equations
- Distance Formula
- Equation of a Circle
- Linear Equations
- Quadratic Equations
- Functions
- Asymptotes
- Inverse Functions
- Transformations
- Regression Curve

Skills

- Simplify algebraic expressions.
- Apply properties of exponents to problem solving situations.
- Find and interpret absolute value of a number.
- Use the distance and mid-point formulas in problem solving.
- Find the equation of a circle and use it to identify the circle's center and radius.
- Solve linear equations and inequalities with fractions
- Solve double inequalities
- Find slope and equations of lines.
- Solve quadratic equations by taking square roots, completing the square, using the quadratic formula, and using the graphing calculator.
- Define functions.
- Find the domain and range of a function as well as it's local extrema and possible horizontal and vertical asymptotes.
- Add, subtract, multiply, and divide functions.
- Compose and decompose functions.
- Define functions parametrically.
- Use inverses of functions
- Apply horizontal and vertical translations of functions.
- Find equations for reflections, stretches, and shrinks of graphs.
- Solve polynomial equations by graphing and by using the remainder, factor and rational root theorems.
- Maximize the volume of a box.
- Fit a curve to a set of data using a regression curve.

Stage 2: Assessment Evidence

Assessments

Daily problem of the day
Formative: Self Assessment
Daily homework assignments
Formative: Self Assessment
Quizzes
Formative: Self Assessment
Chapter tests

Summative: Self Assessment

Stage 3: Learning Plan

Learning Activities

- Model home value appreciation
- Model planetary data using a power function
- Design a box with the maximun volume
- Graph a polynomial function without a calculator
- Use composition of functions to find the volume of a balloon
- Find horizontal and vertical asymptotes without a calculator
- Use a piecewise function to model a mail problem

Resources

Text:
Precalculus - Functions and Graphs
Demana, Waits, Foley, Kennedy
Addison Wesley

Unit Planner: UNIT 4: EXPONENTIAL AND LOGARITHMIC FUNCTIONS
Pre-Calculus Honors

Tuesday, September 6, 2016, 11:39AM

Cedar Grove High School > 2016-2017 > High School > Mathematics > PreCalculus Honors (D) > Week 32 - Week 40

Stage 1: Desired Results

NJ Standards

NJ: 2016 SLS: Mathematics

NJ: HS: Functions

Linear, Quadratic, and Exponential Models

HSF-LE.A. Construct and compare linear and exponential models and solve problems.

HSF-LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

HSF-LE.A.1a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

HSF-LE.A.1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

HSF-LE.A.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

HSF-LE.A.3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

HSF-LE.A.4. Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

HSF-LE.B. Interpret expressions for functions in terms of the situation they model.

HSF-LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.

Enduring Understandings

1. Equations with exponents can model various real life problems.
2. Logistic models can be used to describe many natural occurrences.
3. The same properties apply for exponents and logarithms.
4. Logarithmic functions can be condensed and expanded using laws of exponents.
5. Exponential and logarithmic equations can be solved algebraically and graphically.
6. Exponential and logarithmic equations have many applications in business, finance, and the sciences.
7. Limits of functions are the building blocks of various topics in calculus.

Essential Questions

1. How do we measure the intensity of a sound?
2. What is a model for the population of the U.S.?
3. How can we solve an equation if we don't know an exponent?
4. How are the properties of exponents and logarithms related?
5. How can we measure the intensity of an earthquake?
6. How can we apply Newton's Law of Cooling?
7. How can we find the limit of a function?

Content

1. Graphs of exponential models
2. Exponential regression
3. Logarithmic expressions
4. Properties of logarithms
5. Use logarithms to solve equations
6. Limits

Skills

1. Identify exponential functions
2. Calculate the natural base e
3. Set up and solve growth and decay models
4. Compare exponential and logarithmic functions
5. Solve equations using logs and natural logs
6. Transform logarithmic graphs
7. Expand and condense logarithmic expressions
8. Apply change of base formula
9. Select and apply a regression model
10. Model real life situations using Newton's Law of Cooling
11. Find the limit of a function

Stage 2: Assessment Evidence

Assessments

Daily problem of the day
Formative: Self Assessment
Daily homework assignments
Formative: Self Assessment
Quizzes
Formative: Self Assessment
Chapter tests
Summative: Self Assessment

Stage 3: Learning Plan

Learning Activities

1. Find the monthly payment for a car loan.
2. Use carbon dating to approximate how long ago a tree died.
3. Find the number of bacteria in a petri dish after "n" minutes.
4. Determine altitude from atmospheric pressure.
5. Find the decibel level of a subway car inside a tunnel.
6. Compare chemical acidity levels.
7. Find the time period for an investment to mature.
8. Find the limit of a function with and without a calculator.

Resources

Text:
Precalculus - Functions and Graphs
Demana, Waits, Foley, Kennedy
Addison Wesley