PRECALCULUS 40

Description

This course is the extension of Algebra 32/31 and preparation for calculus in college. It consists of an intensive study of trigonometric functions and their applications. In addition, the course includes polynomial, rational, logarithmic and exponential functions. Precalculus 40 includes an introduction to regression analysis, polar coordinates, vectors and parametric equations.

Course Overview

Course Goals	**Essential Questions**	**Assessments**
Students should:	- How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? - How are quantitative relationships represented by numbers? - How do geometric relationships and measurements help us to solve problems and make sense of our world? - How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?	*Common Assessments* *Skill Assessments*
Content Outline <ol type="I"> - Unit 1 - Defining and Analyzing Functions and Relations - Unit 2 - Trigonometric Functions - Unit 3 - Polar Coordinates - Unit 4 - Polynomial, Rational, Exponential and Logarithmic Functions and Equations - Unit 5 - Statistics - Unit 6 - Vectors	**Standards** State of Connecticut Mathematics Curriculum Frameworks Connecticut State Standards are met in the following areas: ***Algebraic Reasoning: Patterns And Functions*** ***Numerical and Proportional Reasoning*** ***Geometry and Measurement*** ***Working with Data: Probability and Statistics***	**Grade Level Skills** Students will: Skills Matrix

Pacing Guide							
1st Marking Period		2nd Marking Period		3rd Marking Period		4th Marking Period	
September October	November December January		February March		April May		June
Unit 1	Unit 2		Unit 3	Unit 4		Unit 5	Unit 6
Defining and Analyzing Functions and Relations	**Trigonometric Functions**		**Polar Coordinates**	**Polynomial, Rational, Exponential and Logarithmic Functions and Equations**		**Statistics**	**Vectors**
6 weeks	15 weeks		3 weeks	8 weeks		1 weeks	2 weeks

Unit 1 - Defining and Analyzing Functions and Relations, 6 weeks <u>top</u>

Standards

Algebraic Reasoning: Patterns And Functions – Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

1.1 Students should understand and describe patterns and functional relationships.

Core   1.1a Students will describe relationships and make generalizations about patterns and functions.

Extended   1.1a Students will model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

1.2 Students should represent and analyze quantitative relationships in a variety of ways.

Core   1.2a Students should represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.

Extended   1.2a Students will relate the behavior of functions and relations to specific parameters and determine functions to model real world situations.

1.3 Students should use operations, properties, and algebraic symbols to determine equivalence and solve problems.

Core   1.3a Students will manipulate equations, inequalities, and functions to solve problems.

Extended   1.3a Students will use and extend algebraic concepts to include real and complex numbers, vectors, and matrices.

Unit Objectives	Essential Question	Assessment
Students will be able to: • recognize, analyze, and graph functions. Determine the domain and range of functions and perform operations on functions. • solve everyday problems that can be modeled using functions.	• How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? **Focus Questions** • What are the major attributes to analyze a function? • When is a relation a function? • How do you determine the average rate of change of a function? • How do you determine if a function is even or odd graphically or algebraically? • How do you determine the composition of two functions? • What is the domain of a composite function?	• FHTC Fair Haven Telephone Company **Skill Objectives** Students will: • determine x and y intercepts of graphs. • test for x axis, y axis and origin symmetry. • determine, use and interpret the slope of a line as a rate of change. • determine the equation of a line from its graph or its given attributes. • solve linear, quadratic and absolute value equations and inequalities algebraically and graphically. • solve everyday problems that can be modeled using linear and quadratic equations. • determine whether a graph represents a function. • identify the domain and range of a

		function.
		• identify an appropriate symbolic representation for a function or a relation. displayed graphically or verbally.
		• use functions to model problems.
		• determine the average rate of change of a function.
		• determine increasing intervals, decreasing intervals, constant intervals, local maxima and local minima for a function.
		• identify even or odd functions from graphs or equations.
		• sketch the graphs of linear, quadratic, cubic, square root, reciprocal, absolute value and greatest integer functions and their transformations.
		• represent translations, reflections, and dilations of plane figures using sketches, coordinates, vectors, and function notation to examine the effects of transformations and their composites and to solve related geometric problems.
		• graph piecewise-defined functions.
		• perform the operations of addition, subtraction, multiplication, division and composition with functions.
		• find the inverse of a relation from graphs or equations and determine if the inverse is a function.
		• graph functions using transformations.
		• form the composite function and determine its domain.
		• construct and analyze a function.

Unit 2 – Trigonometric Functions, 15 weeks top

Standards

Algebraic Reasoning: Patterns And Functions – Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

1.1 Students should understand and describe patterns and functional relationships.
Core   1.1a Students will describe relationships and make generalizations about patterns and functions.
Extended   1.1a Students will model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

1.2 Students should represent and analyze quantitative relationships in a variety of ways.
Core   1.2a Students should represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.
Extended   1.2a Students will relate the behavior of functions and relations to specific parameters and determine functions to model real world situations.

1.3 Students should use operations, properties, and algebraic symbols to determine equivalence and solve problems.
Core   1.3a Students will manipulate equations, inequalities, and functions to solve problems.

Geometry and Measurement – Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.
Core   3.3a Students will solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.
Extended   3.3a Students will approximate measurements that can not be directly determined with some degree of precision using appropriate tools, techniques and strategies.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.
Extended   3.2a Students will use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technology.

Unit Objective	Essential Questions	Assessment
Students will be able to: • demonstrate an understanding of trigonometric functions, their basic values and their formulas.	• How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? • How do geometric relationships and measurements help us to solve problems and make sense of our world? **Focus Questions** • What are the major attributes of each	• Cul de Sac
		Skill Objectives Students will: • solve right triangles using trigonometric ratios and the Pythagorean Theorem. • apply the Law of Sines and Law of Cosines to solve triangles. • determine the area of a triangle using Sines or Heron's formula. • convert measures of angles between degrees and

	trigonometric function?	radians.
	• How do you determine a sinusoidal function from given data?	• use the relationship between radius, arc length and measure of the central angle of a circle to solve for missing values.
	• How do you determine the exact values of trigonometric functions?	• determine the linear speed of an object traveling along a circular path.
	• How do you determine the approximate values of trigonometric functions?	• find the exact value of trigonometric functions of special angles.
	• How do you convert degree measure to radian measure?	• graph the six basic trigonometric functions and identify their domain and range.
	• How do you convert radian measure to degree measure?	• use the inverse trigonometric functions to solve problems.
	• How are trigonometric identities used to solve trigonometric equations?	• use Double angle formulas for Sine, Cosine and Tangent.
	• How is right triangle trigonometry used to solve right triangles?	• solve trigonometric equations using identities.
	• How are Law of Sines and Law of Cosines used to solve triangles?	• use Sum and Difference formulas.
	• How are Sines and Heron's formulas used to determine area of triangle?	• determine amplitude, period and phase shift of a sinusoidal function.
	•	• graph sinusoidal functions.
		• use sinusoidal functions to model data from real life situations.
		• determine the area of a sector of a circle in radian measure.
		• use a calculator to approximate the values of trigonometric functions.
		• determine the domain and range of trigonometric functions.
		• use even and odd properties to determine the exact values of trigonometric functions.
		• graph transformations of the trigonometric functions.
		• determine an equation for a sinusoidal graph.
		• determine the approximate value of the inverse trigonometric function.
		• solve right triangles and applied problems using right triangle trigonometry.
		• determine an equation for an object in simple harmonic motion.

Standards

Algebraic Reasoning: Patterns And Functions – Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

1.1 Students should understand and describe patterns and functional relationships.

Core   1.1a Students will describe relationships and make generalizations about patterns and functions.

Extended   1.1a Students will model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

1.2 Students should represent and analyze quantitative relationships in a variety of ways.

Core   1.2a Students should represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.

Extended   1.2a Students will relate the behavior of functions and relations to specific parameters and determine functions to model real world situations.

1.3 Students should use operations, properties, and algebraic symbols to determine equivalence and solve problems.

Core   1.3a Students will manipulate equations, inequalities, and functions to solve problems.

Extended   1.3a Students will use and extend algebraic concepts to include real and complex numbers, vectors, and matrices.

Numerical and Proportional Reasoning – Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

2.1 Students should understand that a variety of numerical representations can be used to describe quantitative relationships.

Extended   2.1a Students will extend the understanding of number to include the set of complex numbers.

Geometry and Measurement – Shapes and structures can be analyzed, visualized, measured and transformed using a variety of strategies, tools and technologies.

3.3 Students should develop and apply units, systems, formulas and appropriate tools to estimate and measure.

Core   3.3a Students will solve a variety of problems involving one- two- and three-dimensional measurements using geometric relationships and trigonometric ratios.

3.2 Students should use spatial reasoning, location and geometric relationships to solve problems.

Extended   3.2a Students will use a variety of coordinate systems and transformations to solve geometric problems in two- and three-dimensions using appropriate tools and technology.

Unit Objective	Essential Questions	Assessment
Students will be able to: • solve problems using polar coordinates and polar equations.	• How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? • How are quantitative relationships represented by numbers? • How do geometric relationships and measurements help us to solve problems and	**Skill Objectives** Students will: • plot points using polar coordinates. • convert between polar and rectangular coordinates.

	make sense of our world? **<u>Focus Questions</u>** • What are the major attributes of polar graphs? • How do you convert polar coordinates to rectangular coordinates? • How do you convert rectangular coordinates to polar coordinates? • How do you convert polar equations to rectangular equations? • How do you convert rectangular equations to polar equations?	• use Cartesian, navigational, and polar systems to represent, analyze, and solve geometric and measurement problems. • graph simple polar equations by hand. • graph polar equations using a graphing utility. • perform operations on complex numbers in polar and rectangular form. • graph and identify polar equations by converting to rectangular equations. • test polar equations for symmetry graphically and algebraically.

Unit 4 - Polynomial, Rational, Exponential and Logarithmic Functions and Equations, 8 weeks

Standards

Algebraic Reasoning: Patterns And Functions – Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

1.1 Students should understand and describe patterns and functional relationships.

Core   1.1a Students will describe relationships and make generalizations about patterns and functions.

Extended   1.1a Students will model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

1.2 Students should represent and analyze quantitative relationships in a variety of ways.

Core   1.2a Students should represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs.

Extended   1.2a Students will relate the behavior of functions and relations to specific parameters and determine functions to model real world situations.

1.3 Students should use operations, properties, and algebraic symbols to determine equivalence and solve problems.

Core   1.3a Students will manipulate equations, inequalities, and functions to solve problems.

Extended   1.3a Students will use and extend algebraic concepts to include real and complex numbers, vectors, and matrices.

Numerical and Proportional Reasoning – Quantitative relationships can be expressed numerically in multiple ways in order to make connections and simplify calculations using a variety of strategies, tools and technologies.

2.1 Students should understand that a variety of numerical representations can be used to describe quantitative relationships.

Extended   2.1a Students will extend the understanding of number to include the set of complex numbers.

2.2 Use numbers and their properties to compute flexibly and fluently, and to reasonably estimate measures and quantities.

Extended   2.2a Investigate mathematical properties and operations related to objects that are not numbers.

Unit Objective	**Essential Questions**	**Assessment**
Students will be able to: • solve polynomial, exponential, logarithmic, and rational equations.	• How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? • How are quantitative relationships represented by numbers? **Focus Questions** • How can a graph be used to solve an equation or inequality? • How can a polynomial, rational, exponential or logarithmic equation be solved algebraically? • How can a polynomial or rational inequality be solved algebraically?	• CSI **Skill Objectives** Students will: • solve polynomial and rational inequalities algebraically and graphically. • solve exponential and logarithmic equations algebraically and graphically. • determine the complex zeros of polynomial functions by using a graphing utility, factoring, quadratic formula, and synthetic division. • determine the vertical, horizontal and oblique asymptotes of rational functions

		both algebraically and graphically.
	• How can you determine the features of a graph given the equation? • How can you determine equivalent forms of rational, exponential and logarithmic expressions? • How do you apply the principles of polynomial, rational, exponential and logarithmic functions to real world situations?	• graph polynomial and rational functions by hand and by using a graphing utility. • determine the local extrema of polynomial functions. • compare and contrast the properties of numbers and number systems including rational, real, and complex numbers. • determine the x and y intercepts of rational functions. • determine the domain and range of polynomial and rational functions. • determine any removable discontinuities of rational functions. • evaluate, graph and identify domain and range of exponential and logarithmic functions. • define the number e and the natural logarithmic function. • apply exponential and logarithmic functions to solve problems involving compound interest, future and present value, growth and decay. • identify polynomial functions and their degree, domain, and range. • compare and contrast the properties of numbers and number systems including rational, real, and complex numbers. • determine a polynomial function given specified zeros. • analyze the graph of a rational function. • graph and analyze exponential and logarithmic functions including domain and range. • convert between exponential and logarithmic expressions. • apply the properties of logarithms. • solve problems using any bases.

Unit 5 - Statistics, 1 week [top](#)

Standards

Working with Data: Probability and Statistics – Data can be analyzed to make informed decisions using a variety of strategies, tools and technologies.
4.1 Collect, organize and display data using appropriate statistical and graphical methods.
Extended   4.1a Model real data graphically using appropriate tools, technology and strategies.

Unit Objective	**Essential Question**	**Assessment**
Students will be able to: • draw and interpret graphs of relations and scatter plots by hand using transformations and by using a graphing utility.	• How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions? **Focus Questions** • How can a graphing utility be used to determine a regression equation of best fit? • How can you use the binomial theorem to expand a binomial?	• Scream Machine **Skill Objectives** Students will: • investigate, organize, display, and analyze data in tabular, graphical, and symbolic forms. • make and justify predictions based on patterns and regression models. • determine the polynomial, exponential, logarithmic and trigonometric functions of best fit to data. • determine the polynomial, exponential, logarithmic and trigonometric functions of best fit to data (regression analysis).

Unit 6 – Vectors, 2 weeks

Standards

Algebraic Reasoning: Patterns And Functions – Patterns and functional relationships can be represented and analyzed using a variety of strategies, tools and technologies.

1.1 Students should understand and describe patterns and functional relationships.
Extended   1.1a Students will model real world situations and make generalizations about mathematical relationships using a variety of patterns and functions.

1.3 Students should use operations, properties, and algebraic symbols to determine equivalence and solve problems.
Extended   1.3a Students will use and extend algebraic concepts to include real and complex numbers, vectors, and matrices.

Unit Objective	Essential Question	Assessment
Students will be able to: • use vectors to solve authentic world problems.	• How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? **Focus Questions** • How do you perform operations on vectors? • How can you determine the angle between two vectors? • How can you use vectors to solve real world problems? • How can mathematical induction be used to prove statements true for all n?	**Skill Objectives** Students will: • determine the magnitude of two dimensional vectors. • determine the angle between two vectors in two dimensions. • solve real world problems involving vectors. • construct a graphical representation of a vector. • add vectors. • multiply vectors by a scalar quantity. • determine the dot product of two dimensional vectors. • determine position and unit vectors of two dimensional vectors.