Pre-Calculus - CPM

Course Overview

Pre-Calculus is for students with a very good foundation in Algebra, Geometry and Advanced Algebra. This course includes the study of circular functions, trigonometric functions, solutions of triangles, trigonometric identities, graphs of trigonometric functions, the polar coordinate system, exponential functions, logarithmic functions, and complex numbers. Pre-Calculus is strongly recommended for all 4 year college bound students.

Scope and Sequence

Timeframe	Unit	Instructional Topics
12 Day(s)	Unit 1- Preparing for your Journey	1. Graphs and modeling 2. Composition of Functions/Inverses 3. Radians as a unit of measure
12 Day(s)	Unit 2- Functions and Trigonometry	1. Characteristics of functions 2. Special angles in the unit circle 3. Trig ratios in the unit circle 4. Solving trig equations 5. Inverse sine and cosine
10 days	Unit 3- Algebra and Area under a curve	1. Operations with rational expressions. 2. Solving non-linear systems 3. Polynomial division 4. Using sigma notation 5. Area under a curve
8 Day(s)	Unit 4- Polynomial and rational functions	1. Graphs of polynomials in factored form 2. Writing equations of polynomial functions 3. Identify and using roots of polynomials 4. Writing equations of polynomial functions 5. Graphing transformation of y = 1/x 6. Graphing rational functions 7. Graphing reciprocal functions 8. Polynomial and rational inequalities

8 Day(s)	Unit 5- Exponentials and Logarithms	1. Applications of Exponential Functions 2. Stretching Exponential Functions 3. The Number e 4. Logarithms 5. Properties of Logarithms 6. Solving Exponential and Logarithmic Equations 7. Graphing Logarithmic Functions 8. Applications of Exponentials and Logarithms
10 Day(s)	Unit 6- Limits and Rates	1. An Introduction to LImit 2. Working With One-Sided Limits 3. The Definition of a Limit 4. Limits and Continuity 5. Special Limits 6. Rates of Change from Data 7. Slope and Rates of Change 8. Average Velocity and Rates of Change 9. Moving from AROC to IROC 10. Rate of Change Applications
10 Day(s)	Unit 7- Extending Periodic Functions	1. Graphing y=asin(b(x-h))+k 2. Modeling With Periodic Functions 3. Improving the Spring Problem 4. Graphing Reciprocal Trig Functions 5. Simplifying Trig Expressions 6. Proving Trig Identities 7. Solving Complex Trig Equations
8 Day(s)	Conics and Parametric Functions	1. Circles and Completing the Square 2. Ellipses 3. Hyperbolas 4. Parabolas 5. Identifying and Graphing Conic Sections 6. Intro to Parametrically-Defined Functions 7. Applications of Parametric Equations 8. Conic Sections in Parametric Form

UNIT 1: Preparing for Your Journey

Duration of Unit: 7 Day(s)

Description of Unit: Students will explore a variety of functions in multiple ways and develop concepts that are used in calculus and other advanced math courses. This chapter is important since it provides students with background knowledge that will be used later in the course. Most of the ideas are extensions of concepts they have already learned in previous courses.

Essential Questions and/or Enduring Understandings:
1.1: Introduction to Pre-Calculus
1.2: Inverse and Piecewise-Defined Functions
1.3: Radians and the Unit Circle

ESSENTIAL Standards	Learning Targets
1.1	Students will investigate growth patterns of linear and nonlinear functions.
	Students will investigate the family of quadratic functions to recognize characteristics of their graphs
1.2	Students will make graphs of a variety of functions, including cube root and absolute value functions
	Students will investigate what it means for a relationship to be a function

	Students will learn how to use function notation
NICE TO KNOW Standards	**Learning Targets**

UNIT 2: Linear Relationships

Duration of Unit: 8 Day(s)

Description of Unit: Students will look for connections between the multiple representations of linear functions: table, graph, equation, and situation. Students will also come to a deeper understanding of slope and explore the idea of slope as a rate of change.

Essential Questions and/or Enduring Understandings:
2.1: Slope and y-intercept of a line
2.2: Slope representing real-life
2.3: Finding the equation of a given line

ESSENTIAL Standards	**Learning Targets**
2.1	Students will learn how to connect the starting value and growth in geometric tile patterns with the slope and y-intercept on a graph.
	Students will learn how to measure the steepness of a line on a graph
	Students will learn how to study the difference between lines that point upward, downward, and lines that are horizontal

	and vertical.
2.2	Students will learn to investigate situations where slope represents the speed in real-life situations, culminating in an activity called "The Big Race"
	Students will learn how slope represents rate of change
2.3	Students will learn how to complete the multiple representations web, so that you can find the growth and starting value in various representations, and can convert readily between them.
	Students will learn how to develop an algebraic method for finding the equation of a line when given two points on the line.
NICE TO KNOW Standards	**Learning Targets**

UNIT 3: Simplifying and Solving

Duration of Unit: 8 Day(s)

Description of Unit: Students will focus on multiplying expressions. They will also solve equations that contain products. Students will be using algebra tiles but will also develop a method without using tiles.

Essential Questions and/or Enduring Understandings:
3.1: Simplifying Exponential Expressions
3.2: Multiplying Binomials
3.3: Solving Equations

ESSENTIAL Standards	Learning Targets
3.1	Students will solve multi-variable equations for one of the variables.
3.2	Students will learn how to use algebra tiles to physically and visually represent an equation.
	Students will develop a method to rewrite products of binomials and other polynomials using algebra tiles and generic rectangles.
	Students will multiply polynomial expressions using algebra tiles and use the Distributive Property with polynomial expressions.
3.3	Students will solve one-variable equations containing products.
	Students will solve one-variable equations containing absolute value.
	Students will solve multi-variable equations for one of the variables.
NICE TO KNOW Standards	Learning Targets

UNIT 4: System of Equations

Duration of Unit: 7 Day(s)

Description of Unit: Students will learn how to solve word problems by writing a pair of equations, called a system of equations. They will solve the system of equations with multiple representations, including a table, graph, and equation.

Essential Questions and/or Enduring Understandings:
4.1: Writing Mathematical Sentences
4.2: Solving Systems of Equations
4.3: Making Connections

ESSENTIAL Standards	Learning Targets
4.1	Students will write one-variable equations to solve situational word problems.
	Students will write and solve two-variable equations to solve situational word problems.
4.2	Students will solve systems of equations by substitution.
	Students will solve systems of equations by graphing.
	Students will solve systems of equations by elimination.
	Students will develop ways to determine which solving method is most efficient and accurate.
4.3	Students will make connections between solving equations, multiple representations, and systems of equations.
NICE TO KNOW Standards	Learning Targets

UNIT 5: Sequences

Duration of Unit: 7 Day(s)

Description of Unit: Students will review and strengthen their algebra skills while learning about arithmetic and geometric sequences. Students will be looking for patterns and making tables to write algebraic equations describing sequences of numbers. They will also develop shortcuts for writing equations for certain kinds of sequences.

Essential Questions and/or Enduring Understandings:
5.1: Exponential Growth and Decay
5.2: Arithmetic Sequences
5.3: Geometric Sequences

ESSENTIAL Standards	Learning Targets
5.1	Students will describe the growth and decay of various situations.
	Students will compare sequences to functions.
5.2	Students will investigate and categorize several sequences.
	Students will create multiple representations of arithmetic sequences, including equations for sequences that depend on previous terms.
5.3	Students will compare the growth of various sequences.
	Students will recognize growth by multiplication and growth by addition.
	Students will create multiple representations of geometric sequences.
	Students will compare sequences to functions.

NICE TO KNOW Standards	Learning Targets

UNIT 6: Modeling Two-Variable Data

Duration of Unit: 7 Day(s)

Description of Unit: Students will be describing a dependent relationship, called the association, between two numerical variables. You will use scatter-plots of data to create lines and curves that model the data and then use those models to make predictions. You will mathematically describe the form, direction, strength, and outliers of an association.

Essential Questions and/or Enduring Understandings:
6.1: Line of Best Fit- Part 1
6.2: Line of Best Fit- Part 2

ESSENTIAL Standards	Learning Targets
6.1	Students will "Eyeball" a line of best fit and use it to make predictions.
	Students will interpret the slope and y-intercept in a statistical situations.
	Students will describe the form, direction, strength, and outliers of an association.
	Students will calculate residuals and create upper and lower bounds for predictions that you make.
	Students will use their calculators to create the unique line of best fit called the least squares regression line.

	Students will use their calculators to create the unique line of best fit called the least squares regression line.
6.2	Students will create residual plots and analyze them to determine whether a model is an appropriate fit to the data.
	Students will calculate the correlation coefficient and R-squared and interpret them in context.
	Students will use more mathematical terms to describe the form, direction, and strength of an association.
	Students will discover that "association is not causation" because there might be a lurking variable.
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	Students will fit curved best-fit models to non-linear scatter-plots.
NICE TO KNOW Standards	**Learning Targets**

UNIT 7: Exponential Functions

Duration of Unit: 7 Day(s)

Description of Unit: Students will learn about the family of exponential functions. They will build more advanced algebra skills, such as solving for an indicated variable, simplifying or rewriting exponential expressions, working with fractional exponents, and finding the exponential function that passes exactly through any pair of given points.

Essential Questions and/or Enduring Understandings:
7.1: Family of Exponential Functions

7.2: Curve Fitting for Exponential Functions

ESSENTIAL Standards	Learning Targets
7.1	Students will investigate the characteristics of a family of exponential functions.
	Students will recognize exponential growth when given situations, tables, graphs, or equations.
	Students will extend their knowledge of exponents and their properties to solve exponential equations.
	Students will recognize and describe step functions.
	Students will apply exponential function relationships to real-life growth and decay situations.
7.2	Students will evaluate given data to write an exponential equation that fits the data.
	Students will apply their knowledge of fractional exponents to solve equations.
	Students will solve a system of exponential functions graphically.
NICE TO KNOW Standards	Learning Targets

UNIT 8: Quadratic Functions

Duration of Unit: 7 Day(s)

Description of Unit: Students will be challenged to find connections between the different representations of a quadratic function. They will learn how to rewrite quadratic equations in several forms as well as learn how their graphing calculator can provide help.

Essential Questions and/or Enduring Understandings:
8.1: Writing Quadratic Functions
8.2: Representing Quadratic Functions

ESSENTIAL Standards	Learning Targets
8.1	Students will develop a method to change a quadratic equation written as a sum into its factored form.
	Students will learn shortcuts for factoring some quadratic expressions.
8.2	Students will generate each representation of a quadratic function - rule, graph, table and situation.
	Students will develop a method to find the x-intercepts of a parabola using the Zero Product Property.
	Students will be introduced to another way to write the equation of a parabola called graphing form.
	Students will use square roots to find the x-intercepts of a parabola written in graphing form.
	Students will complete the square to change between standard form and graphing form of a quadratic function.
NICE TO KNOW Standards	Learning Targets

UNIT 9: Solving Quadratics and Inequalities

Duration of Unit: 8 Day(s)

Description of Unit: Students will extend their ability to solve quadratic equations and decide which method of solving is most efficient.

Essential Questions and/or Enduring Understandings:

ESSENTIAL Standards	Learning Targets
9.1	Students will solve quadratic equations using the Quadratic Formula.
	Students will compare strategies to solve quadratic equations and choose the most efficient one.
9.2	Students will solve linear, one-variable inequalities.
	Students will apply their understanding of inequalities to solve application problems.
9.3	Students will represent solutions to one-variable inequalities on a number line.
	Students will represent the solutions of two-variable inequalities on an x-->y graph.
9.4	Students will apply what they know about systems of equations to find the solutions to systems of inequalities.
	Students will graph the solution of a system of inequalities.
NICE TO KNOW Standards	Learning Targets

UNIT 10: Solving Complex Equations

Duration of Unit: 9 Day(s)

Description of Unit: Students will extend their solving skills to include other types of equations such as those with square roots, absolute values, variables in exponents, and messy fractions. They will learn how to determine the number of possible solutions for an equation without actually solving them. Students will also consider imaginary solutions to quadratic equations. They will focus on using the intersection of the graphs of two functions to find the solution to an equation as well as solve quadratic and absolute value inequalities.

Essential Questions and/or Enduring Understandings:
10.1: Association in Two-Way Tables
10.2: Solving Unfamiliar Equations
10.3: Solving by Graphing

ESSENTIAL Standards	Learning Targets
10.1	Students will determine association of categorical data that is represented on two-way tables.
10.2	Students will develop new ways to solve unfamiliar, complicated equations involving fractions, square roots, exponents, and absolute values.
	Students will determine the number of solutions that are possible for quadratic and absolute value equations without solving them.
	Students will be introduced to a new kind of number called an imaginary number.

10.3	Students will understand the difference between intercepts and intersections.
	Students will find the intersection of two functions.
	Students will use the intersection of two functions to estimate the solution of very complex equations.
	Students will solve quadratic and absolute value inequalities.
NICE TO KNOW Standards	**Learning Targets**

UNIT 11: Functions and Data

Duration of Unit: 9 Day(s)

Description of Unit: Students will start this chapter by looking at how you can change functions and then how you can "undo" functions. Then you will model a golf game and compare your results with other teams. You will review the ways to graphically show data, and decide whether to use scatter plots or two histograms to compare two variables. You will sue statistics to compare two sets of data: center, shape, spread, and outliers. Finally, you will learn a new way to describe the variability (the spread) in data called the standard deviation. The course ends with some challenging investigations in which you will draw upon some of the mathematics you have learned this year in order to solve the problems.

Essential Questions and/or Enduring Understandings:
11.1: Transforming and finding the inverse of polynomials

11.2: Graphically Show and Compare Data 11.3: Challenging Culminating Problems	

ESSENTIAL Standards	Learning Targets
11.1	Students will add or multiply be a constant to transform linear, quadratic, and exponential functions.
	Students will investigate some challenging, culminating problems that will give them a chance to use some of the
11.2	Students will review the differences between graphical representations of single-variable data.
	Students will compare the center, shape, spread, and outliers of two distributions.
	Students will compare the center, shape, spread, and outliers of two distributions.
	Students will develop a new way to describe the spread called standard deviation.
11.3	Students will investigate some challenging, culminating problems that will give them a chance to use some of the mathematics they have learned this year.
NICE TO KNOW Standards	Learning Targets