Pre Calculus [P]

Gorman Learning Center (052344)

Basic Course Information

Title:
Pre Calculus [P]

Transcript abbreviations:
Pre-calc

Length of course:
Full Year

Subject area:
Mathematics ("c") / Advanced Mathematics

UC honors designation?
No

Prerequisites:
None

Co-requisites:
None

Integrated (Academics / CTE)?
No

Grade levels:
11th, 12th

Course learning environment:
Classroom Based

Course Description

Course overview:

Pre Calculus [P] is a yearlong advanced college prep course designed to meet more than the basic college-level entry requirements in mathematics. The course is designed to allow students to gain a deeper and broader understanding of the concept of function, and how different functions are used as tools to create mathematical models for real situations. Students will learn to work with functions in four different ways: graphically, numerically, algebraically, and verbally and will understand the connections between these representations. Functions that will be studied include linear, quadratic, polynomial, rational, exponential, trigonometric, and piecewise defined functions. Students will also study additional topics including systems of equations and inequalities, sequences and series, vectors, polar equations and graphs, conic sections and the use of technology to solve problems relating to the above-mentioned topics.

The Pre Calculus program is designed to challenge the academically able student to pursue a program of mathematical excellence and to develop an appreciation and mastery of advanced math topics.
The student will:

- Be able to solve a wide-variety of equations (linear, trigonometric, exponential, logarithmic, etc.), numerically, algebraically and graphically.
- Be able to graph (roots, asymptotes, symmetry, etc.), both by hand and with a graphing utility, a wide-variety of functions and will understand the role that each of those characteristics play in relation to the function itself.
- Develop mathematical skills in the areas of algebraic, geometric, trigonometric, exponential, logarithmic, exponential, and polar functions.
- Be able to solve a system of linear equations and inequalities with a variety of methods (graphing, substitution, linear combination, and so forth).
- Be exposed to concepts of advanced polar, parametric, and vector-related mathematical topics (including the uses of complex numbers).
- Be able to apply the above-mentioned knowledge to solve real world problems.
- Use technology as a tool for problem solving and for developing an appropriate mathematical model to match provided data.

Course content:

*The shaded background of the following field indicates this course was approved by UC for the 2014-15 school year or earlier. Please refer to the current "a-g" course criteria and guidelines when completing your course submission form.*

**Units**

**Course Content**

**Relations, Functions, and Graphs**

I. Linear Relations and Functions

Students will learn:

- to differentiate between relations and functions.
- to identify the domain and range of given functions of all types.
- to model real-world data using linear functions.
- to find the composition of two functions.
- to graph piecewise defined functions.

II. Systems of Linear Equations and Inequalities

Students will learn:

- to solve systems of two equations with two variables and three equations with three variables.
- to solve systems of two or more inequalities by graphing.
- to solve linear programming problems.
III. The Nature of Graphs

Students will learn:

- to identify symmetry in functions and use it to assist in graphing those functions.
- to identify families of functions (absolute value, quadratic, cubic, quartic, square root, rational, and greatest integer) and their transformations.
- to use families of functions and transformations to graph functions and their inverses.
- to find the inverse of a function and to identify it as a function or relation.
- to find critical points and extrema of functions.
- to graph rational functions and identify their asymptotes.

IV. Polynomial and Rational Equations

Students will learn:

- to graph and find the zeros of polynomial functions.
- to use the Remainder, Factor, and Rational Root Theorems to factor polynomials and find their roots.
- to solve rational equations and inequalities.
- to solve radical equations and inequalities.

Assignments for this unit: Students will be expected to complete daily homework, often from the textbook, in order to reinforce the ideas and skills presented in class. An example of a key assignment might be solving a linear programming problem where students must determine the maximum possible profit given a business situation in which constraints are described. Students would have to translate the constraints into algebraic inequalities, find the feasible region and determine from that what the maximum profit would be. Another key assignment might be building a box of maximum volume based on the graphical analysis of its volume function.

Advanced Functions and Graphing

1. Conic Sections

Students will learn:

- to use analytic geometry to prove geometric relationships on the coordinate plane.
- to convert the general equation of a conic section (circle, ellipse, parabola, hyperbola) to standard form in order to identify its key features and to graph it.
• to recognize conic sections by their equations.
• to graph and solve systems of second degree equations.

II. Exponential and Logarithmic Functions

Students will learn:

• to simplify and evaluate expressions containing rational and irrational exponents.
• to use and graph exponential functions and inequalities.
• to evaluate expressions and to graph and solve equations involving logarithms.
• to model real-world situations and to solve problems using common and natural logarithms.

Assignments for this unit: Along with daily homework assignments, students could be asked to do problems like finding the age of a painting using carbon-14 dating or finding out how long it takes for certain radioactive elements to break down. These problems would require students to use the data given to formulate an exponential equation for which they would have to use logarithms to solve.

Trigonometry

I. The Trigonometric Functions

Students will learn:

• to convert decimal degree measures to degrees, minutes, seconds and vice versa.
• to convert degrees into radians and vice versa.
• to identify angles that are coterminal with a given angle.
• to find the values of trigonometric functions on the unit circle.
• to use trigonometry, the Law of Sines, and/or the Law of Cosines to solve triangles.
• to use trigonometry to find the areas of triangles.

II. Graphs of Trigonometric Functions

Students will learn:

• to use and draw graphs of trigonometric functions and their inverses.
• to find the amplitude, period, phase shift, and vertical shift for trigonometric functions.
• to write trigonometric equations to model a given situation.

III. Trigonometric Identities and Equations

Students will learn:

• to use reciprocal, quotient, Pythagorean, symmetry, and opposite-angle identities to simplify trigonometric expressions or to aid in solving trigonometric equations.
• to verify trigonometric identities.
• to use sum, difference, double-angle, and half-angle identities to simplify trigonometric expressions or to aid in solving trigonometric equations.
• to solve trigonometric equations and inequalities.

IV. Vectors

Students will learn:

• to add, subtract, and multiply vectors in both geometric and algebraic form.
• to represent vectors as ordered pairs or ordered triples.
• to solve problems using vectors.

V. Polar Coordinates

• to become familiar with the polar coordinate system and to represent a point on the polar grid in multiple ways.
• to graph polar equations.
• to convert polar equations to rectangular equations and vice versa.

Assignments for this unit: In addition to regular homework assignments from the textbook, students might be asked to use a trigonometric function to model the motion of a ferris wheel, to plot the hours of daylight for a year at a given location on the globe and to find a trigonometric function that describes that data, or to use vectors to solve a problem involving navigation in the air or on the sea. In all of these cases, students would be expected to draw a graph or diagram and to formulate an equation for a function that would assist them in answering the question. They would then have to use their equation and the given data to solve for the missing values.

Discrete Mathematics

I. Sequences and Series

Students will learn:

• to identify and find nth terms of arithmetic, geometric, and infinite sequences.
• to find sums of arithmetic, geometric, and infinite series.
• to determine whether a series is convergent or divergent.
• to use sigma notation to represent the sum of a series.

Assignments in this unit: In addition to daily homework and classwork assignments from the textbook and other sources, students might be asked to use sequences and series to explore the properties of fractals. Through exploration of different sequences and series, students will
explore the concept of limits and use this to determine convergence and divergence of infinite sequences and series.

**Course Materials**

**Textbooks**

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