

# Precalculus

*Approved by Instructional Council December 10, 2009*

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### **Course Overview:**

This course provides students with an opportunity to meet the following academic expectations:

- Speak clearly and communicate ideas accurately in a variety of settings
- Employ problem solving skills effectively
- Demonstrate critical thinking skills

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### **Course Units**

- I. Unit 1      Functions and their Graphs
- II. Unit 2     Linear and Quadratic Functions
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**Key to Coding:**

In order to assure that this curriculum document is aligned with the most recent Connecticut State Frameworks, we have adopted a coding method to inform the user of this document of the precise connection to the frameworks.

The Connecticut State Frameworks consists of four strands, Geometry and Measurement (GM), Algebraic Reasoning: Patterns and Functions (AR), Numerical and Proportional Reasoning (NPR) and Working with Data: Probability and Statistics (WD). Each content strand is composed of an Essential Question with two to three components. Each component consists of one to two performance standards. Each standard consists of two to four performance expectations.

Each strand of the Frameworks is divided into a set of Core Content Standards and Expected Performances and a set of Extended Content Standards and Expected Performances. The Core is the set of standards the state expects every student to be able to know by the 10<sup>th</sup> grade and therefore can be tested on the CAPT. The Extended set of standards is the set of standards that not all students will reach by the 10<sup>th</sup> grade, if at all. Several examples of coding used in the document follow:

A Focus Question coded as (**ARCore**:1.2a) refers to the core content strand Algebraic Reasoning: Patterns and Functions (**ARCore**), second component of the strand (1.2) and performance standard (a) within this component.

A Benchmark or Required Activity coded as (F2, **GMCore**:3.3a.4) refers to the Unit Focus Question 2 (F2), the core content strand Geometry and Measurement (**GMCore**), third component of the strand (3.3), performance standard (a) and performance expectation (4).

A Benchmark or Required Activity coded as **GMExtended** refers to the extended content standards for Geometry and Measurement.

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Unit 1: Functions and their Graphs

**Abstract**

Families of basic functions and their graphs will be studied using the graphing calculator as a tool. Characteristics of graphs for each family will include domain and range, continuity, extrema, and end behavior. In addition, students will determine how to transform parent functions. Student mastery of unit one benchmarks is essential for the comprehension of more rigorous algebraic reasoning and problem solving throughout the course.

Essential Questions: How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? How do numbers represent quantitative relationships? How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?

Focus Questions:

1. What is a function and describe its characteristics?
2. Why are function groups referred to as families?
3. How can real-world situations be represented using functions?

Benchmarks:

The student will be able to

1. determine whether a relation represents a function by using the formal definition of function and by viewing the associated graph.
2. evaluate functions for given values and express domain and range using interval notation.
3. write function sums, differences, products and quotients as simple algebraic expressions.
4. graph functions and identify characteristics, including even/odd, increasing/decreasing, maximums/minimums.

5. identify and sketch families of basic graphs and their transformations on the coordinate plane.

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-1, 3, 4; 1.2-a-1, 3, 4  
AR Extended 1.1-a-3; 1.2-a-1, 2  
GM Extended 3.2-a-3

Technology Education Framework Connection:

Content Standards  
Calculators: graphing utility

Required Activities (Common Experiences):

PH PRECALCULUS text p. 124.

Chapter Project I: Cell Phone Service

- Determine the total cost of each plan for the life of the contract.
- Determine which plan provides the best deal based on usage constraints.
- Write and Graph each cost function
- Determine which plan provides the best deal based on individual cell phone usage.

Suggested Activities: *Instructor's Resource Center (IRC)*

PH PRECALCULUS text p. 124

Chapter Project II: Project at Motorola - Wireless Internet service plans

Chapter Project III: Cost of Cable - Using the Pythagorean Theorem to assess the cost of installation of new cable lines.

Chapter Project IV: Oil Spill - Using functions to analyze the size and spread of an oil spill from a leaking tanker.

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator (TI-83 or TI-84)  
PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, Chapter 2

Pacing: Level 1: 9 days; Level 2: 9 days  
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### Unit 2: Linear and Quadratic Functions

#### **Abstract**

Students continue their study of functions focusing on the specific categories of linear and quadratic functions. Properties and applications of these functions will be fully investigated using algebraic and graphing approaches. The graphing calculator is used to explore the characteristics of each function, extending the basic family features from the first unit. Students will draw connections between rates of change in real-life situations to slopes of linear models. Connections are also drawn between zeros/x-intercepts of quadratics and real-life scenarios. The vertex of a parabola will be recognized as a maximum or minimum value of the function, and used to answer questions involving authentic, reality based problems. Students will review the three different methods to solve quadratics, previously introduced in Algebra 2. Applications such as projectile motion, free falling objects and maximum/minimum values are embedded in the unit.

#### Essential Question:

How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? How do numbers represent quantitative relationships? How do geometric relationships and measurements help us to solve problems and make sense of our world?

#### Focus Questions:

1. How does understanding the notion of "rate of change" help us in our daily lives?
2. How are quadratics solved and what do the solutions mean?
3. How can real-world situations be modeled by quadratic functions?

#### Benchmarks:

The student will be able to

1. relate, interpret, and calculate slope as a rate of change in real-life situations.
2. write linear equations using a variety of forms including slope-intercept, standard, and point-slope forms.
3. write linear functions of parallel and perpendicular lines.

4. graph quadratic functions by algebraically calculating the vertex, axis of symmetry and finding another point on graph.
5. solve quadratic equations using methods of factoring, completing the square, and quadratic formula.
6. write and solve quadratic equations to solve real world problems.

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-3; 1.2-a-1, 2, 3, 4; 1.3-a-1, 2  
AR Extended 1.1-a-1, 2, 3; 1.2-a-1, 2, 3; 1.3-a-1  
PS Extended 4.1-a-1, 2, 3

Technology Education Framework Connection:

Content Standards  
Calculators: graphing utility

Required Activities (Common Experiences):

PH PRECALCULUS text, p. 172

Chapter Project I: Analyzing a Stock (may use Internet website *finance.yahoo.com*)  
Students create linear models regarding stock rates of return, using Internet information, given formulas, and the graphing calculator. Students compare computed results with that of the Value Line Investment Survey found in the library.

Suggested Activities: *Instructor's Resource Center (IRC)*

PH PRECALCULUS text p. 172

Chapter Project II: Cannons - Using weight of a missile, its initial velocity, and gun position, students determine where the missile will travel.

Chapter Project IV: CBL Experiment - A computer simulation used to study the physical properties of a bounding ball.

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator (TI-83 or TI-84)

PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, **Chapter 3**  
Connections:

Pacing:           Level 1: 8 days  
                          Level 2: 12 days

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Unit 3: Polynomial and Rational Functions

**Abstract**

Students extend their prior knowledge of polynomial and rational expressions to learn about polynomial and rational functions. Rational functions are ratios of polynomial functions. Students will examine their properties and use them to approximate other, more complicated functions. Students begin by defining and identifying polynomial functions by their equation and graphical representation. Students perform operations on polynomials, recalling how to divide polynomials using both long and synthetic division. Several theorems about the roots of polynomial equations are studied including the Remainder theorem, Factor theorem, Rational Zero theorem, and Descartes' Rule of Signs. Finally, students apply these skills by modeling authentic data with a best-fit polynomial function. Students draw conclusions about the data by analyzing the features of the model's equation and graph.

Essential Question:

How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? How do numbers represent quantitative relationships?

Focus Questions:

1. How are rational functions related to polynomial functions?
2. What do real zeros of a function look like?
3. Why are asymptotes significant in the study of rational functions?
4. How can polynomial functions be used to model real-life situations?

Benchmarks:

The student will be able to:

1. identify polynomial functions and their degree.
2. graph polynomial functions using transformations
3. describe the characteristics of polynomial functions including: range, domain, zeros and end behaviors.

4. graph and describe the characteristics of rational functions including: range, domain, zeros, end behaviors and asymptotes.
5. solve applied problems involving rational functions, such as minimizing cost, determining drug concentration in the blood stream, minimizing surface area
6. divide polynomials by long and synthetic division to find factors of polynomials.
7. apply the Remainder theorem to find remainders when polynomials are divided by binomials.
8. apply the Remainder and Factor theorems to find factors of polynomial functions
9. apply the Rational Zero theorem to list the potential rational zeros of a polynomial function
10. view the graph of the polynomial function on the graphing calculator to determine which of the potential rational zeros are probable.
11. find the real zeros of a polynomial function using the potential rational zeros, synthetic division, and other factoring techniques to factor the polynomial function.
12. find bounds to the zeros of the polynomial using the Theorem for Bounds on Zeros in order to view real zeros on the graphing calculator.
13. using a graphing calculator, find a polynomial function which best fits the scatter plot of authentic data. Analyze the function's equation and graph to determine the numbers of real and complex zeros. Interpret the end-behaviors of the graph as it relates to the data.

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-3; 1.2-a-1, 2, 3, 4; 1.3-a-1, 2  
 AR Extended 1.1-a-1, 2, 3, 7; 1.2-a-1; 1.3-a-1  
 NR Extended 2.1-a-2, 3, 2.2-a-2

Technology Education Framework Connection:

Content Standards  
 Calculators: graphing utility

Required Activities (Common Experiences):

Chapter Project I: Weed Pollen - Use a graphing calculator to investigate different regression models and determine which function best fits the scatter plot of data.

Analyze the graph to determine the degree of the polynomial, the number of real zeros, complex zeros, etc.

Suggested Activities:

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator

PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, **Chapter 4**

Pacing:           Level 1: 12 days  
                          Level 2: 12 days

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Unit 4: Exponential and Logarithmic Functions

**Abstract**

This unit begins with a discussion of composite, one-to-one, and inverse functions. The inverse relationship between exponential and logarithmic functions is learned and utilized to solve for unknown values of powers. Use of the graphing calculator enhances the instruction of this unit with students having the ability to view tables and graphs of functions involving extreme values. Students will have the opportunity to work with exponential and logarithmic functions that occur frequently in a wide variety of applications, such as biology, chemistry, economics, and psychology.

Essential Question: How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? How do numbers represent quantitative relationships?

Focus Questions:

1. What is a logarithmic function and what are its characteristics?
2. How are exponential and logarithmic functions related?
3. How are exponential and logarithmic functions used in business, science and medical professions?

Benchmarks:

The student will be able to

1. form and evaluate a composite function, given two separate functions
2. find the components of a composite function and write as two separate functions
3. determine whether a function is one-to-one algebraically and graphically using the horizontal line test
4. define, find, and graph the inverse of a function and determine restrictions on its domain.

5. evaluate and graph exponential functions; summarize the properties of the exponential function using graphical and algebraic terms
6. solve exponential equations and applied problems algebraically
7. solve exponential equations and applied problems graphically, using the graphing calculator
8. interchange exponential statements and logarithmic statements using the definition of a logarithm.
9. evaluate and graph logarithmic functions; summarize the properties of the logarithmic function using graphical and algebraic terms
10. solve logarithmic equations and applied problems algebraically
11. solve logarithmic equations and applied problems graphically, using the graphing calculator

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-1, 2, 3, 4; 1.2-a-1, 2, 3, 4; 1.3-a-2  
AR Extended 1.1-a-1, 2, 4; 1.2-a-1, 2; 1.3-a-1, 3  
NR Extended 2.1-a-1, 2, 4; 2.2-a-2

Technology Education Framework Connection:

Content Standards  
Calculators: graphing utility

Required Activities (Common Experiences):

PH PRECALCULUS text, p. 349

Chapter Project I: Hot Coffee - Determine which coffee container a restaurant should purchase based on liquid temperature, the rates of cooling using the different containers, and the optimal drinking temperature.

Suggested Activities: *Instructor's Resource Center (IRC)*

PH PRECALCULUS text, p. 349

Chapter Project II: Project at Motorola - Analyze a cell phone's ability to withstand temperature change using logarithmic transformation

Chapter Project III: Depreciation of a New Car - compare the depreciation rates of different makes and models using exponential functions

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator (TI-83 or TI-84)

PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, **Chapter 5**

Pacing:           Level 1: 13 days  
                          Level 2: 13 days

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Unit 5: Trigonometric Functions

**Abstract**

Students were first introduced to trigonometry in a geometry unit on right triangles. They learned how to apply the Pythagorean Theorem and trig ratios to determine missing side and angle measurements indirectly. Students will extend their knowledge of right triangle trigonometry as this unit develops the trigonometric functions using the unit circle. The six trigonometric functions will be defined and properties developed. Students will graph the trig functions by hand and using the graphing calculator, making note of each function's properties involving amplitude, period, and vertical and horizontal phase shifts.

Essential Question: How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? How do numbers represent quantitative relationships?

Focus Questions:

1. How does right triangle trigonometry relate to trigonometry in a unit circle?
2. How does a change in amplitude affect a function's graph?
3. Where can the graphs of trigonometric functions be found in our every day lives?

Benchmarks:

The student will be able to (in both radians and degrees)

1. convert angles to either unit using conversion equations
2. calculate arc length and angular speed using given formulas
3. use the unit circle to develop and commit to memory the six trigonometric functions
4. use the unit circle to develop and commit to memory the exact values of the six trigonometric functions for the special angles
5. identify domain, range, period, amplitude, phase shift and vertical shift of trigonometric functions.

6. graph the trigonometric functions by hand and by graphing calculator, using the properties of period, amplitude, phase shift and vertical shift
7. commit to memory the six basic trigonometric graphs.
8. use sinusoidal graphs and equations to model and solve real world applications

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-1, 2, 3; 1.2-a-1, 2, 3, 4  
AR Extended 1.1-a-1; 1.2-a-1, 2  
NR Extended 2.1-a-2  
GM 3.3-a-2  
GM Extended 3.2-a-3

Technology Education Framework Connection:

Content Standards  
Calculators: graphing utility

Required Activities (Common Experiences):

PH PRENTICE HALL text, p. 437

Chapter Project I: Tides - Given a table of High Tide and Low Tide data, create a scatter plot on the graphing calculator. Find a sine curve to model the data. Analyze the curve to determine amplitude and period of the model. Use the model to predict future high and low tides.

Suggested Activities: *Instructor's Resource Center (ICR)*

PH PRENTICE HALL text, p. 438

Chapter Project III: Identifying Mountain Peaks in Hawaii - Use trigonometry to determine whether a distant object can be seen using information about a mountain's altitude, distance from the viewer and curvature of the Earth's surface.

Chapter Project IV: CBL Experiment - Use technology to model and study the effects of damping on sound waves.

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator (TI-83 or TI-84)

PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, **Chapter 6**

Pacing:           Level 1: 10 days  
                          Level 2: 13 days

Notes to Teachers:  
SAT Study Guide

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Unit 6: Analytic Trigonometry

**Abstract**

In this unit, trigonometric identities are derived. These identities play an important role in calculus, the physical and life sciences, and economics, where they are used to simplify complicated expressions. At the end of the unit, students will solve equations that contain trigonometric functions.

Essential Question: How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? How do numbers represent quantitative relationships?

Focus Questions:

1. Why is it important to understand how trigonometric identities were derived?
2. How can trigonometric identities be used outside of the calculus classroom?

Benchmarks:

The student will be able to

1. identify the inverses of the trigonometric functions, graph them, and utilize them to solve equations.
2. use the basic identities and algebraic manipulations to simplify trigonometric expressions
3. apply the sum and difference,  $\frac{1}{2}$  angle, and double angle identities to determine trigonometric values.
4. solve linear and quadratic equations involving trigonometric functions.

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-1, 2, 3; 1.2-a-1, 2, 3, 4; 1.3-a-3  
AR Extended 1.1-a-1; 1.2-a-1, 2; 1.3-a-1  
NR Extended 2.1-a-2  
GM 3.3-a-2  
GM Extended 3.2-a-3

Technology Education Framework Connection:

Content Standards  
Calculators: graphing utility

Required Activities (Common Experiences):

PH PRECALCULUS text, p. 507

Chapter Project I: Waves - investigation of a vibrating string and its wave motion

Suggested Activities: *Instructor's Resource Center (ICR)*

Chapter Project II: Project at Motorola - Sending pictures wirelessly

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator (TI-83 or TI-84)

PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, **Chapter 7**

Pacing:           Level 1: 8 days  
                          Level 2: 10 days

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Unit 7: Trigonometric Applications

**Abstract**

In this unit students revisit the trigonometric functions in the context of right triangles to solve applied problems. The students extend their knowledge of right triangle and unit circle trigonometry to solve problems involving oblique triangles (non-right triangles), using the Laws of Sines and the Law of Cosines. Formulas to help solve problems involving triangle area are also developed.

Essential Question: How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? How do numbers represent quantitative relationships?

Focus Questions:

1. How can trigonometry be used to solve real-life problems?
2. Why is it important to understand right triangle trigonometry for the study of trigonometry in oblique triangles?

Benchmarks:

The student will be able to

1. solve problems using right angle trigonometry
2. develop the Laws of Sines and Cosines using right angle trigonometry
3. apply the Laws of Sines and Cosines to solve real life applications
4. find the area of non-right triangles using trigonometric properties and Heron's formula

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-1, 2, 3; 1.2-a-1, 2, 3, 4; 1.3-a-1

AR Extended 1.1-a-1; 1.2-a-1, 2; 1.3-a-1

NR Extended 2.1-a-2

GM 3.1-a-1; 3.3-a-2  
GM Extended 3.2-a-3

Technology Education Framework Connection:

Content Standards

Calculators: graphing utility

Required Activities (Common Experiences):

PH PRECALCULUS text, p. 559-560

Chapter Project V: Locating Lost Treasure - Use the Law of Sines to find a buried treasure

Chapter Project VI: Jacob's Field - Use Law of Sines and angles of elevation to determine the height of the stadium wall and the distance from home plate to the top of the wall

Suggested Activities:

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator (TI-83 or TI-84)

PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, **Chapter 8**

Pacing:           Unit 7: 9 days  
                          Unit 7: 10 days

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Unit 8: Vectors, Polar Coordinates and Parametric Equations

**Abstract**

This unit is comprised of three parts: vectors, parametric equations, and polar coordinates. In part one, students learn the basics about vectors: notation, magnitude, direction, graphing, and simple operations. In part two, students extend their knowledge of solving and graphing equations in two variables involving  $x$  and  $y$ , to learn about solving and graphing equations involving polar coordinates. Lastly, students will graph and solve parametric equations. The three topics are independent of each other and may be discussed in any order.

Essential Question: How do numbers represent quantitative relationships? How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions:

1. How is solving a two variable equation involving  $x$  and  $y$  different than solving a two variable equation involving polar coordinates?
2. What kind of real life scenario would require the use of parametric equations?
3. How are vector operations and properties used to describe real world applications involving direction?
4. How are polar coordinates and equations different from rectangular systems?

Benchmarks:

The student will be able to

1. graph vectors on a grid
2. find a position vector using the definition equation
3. add and subtract vectors algebraically
4. plot points using polar coordinates

5. convert coordinates and equations between polar and rectangular measures
6. graph polar equations using a graphing calculator
7. graph parametric equations by hand and using a graphing calculator
8. convert rectangular equations to parametric form
9. use parametric equations to solve real world applications

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-1, 2, 3; 1.2-a-1, 2, 3, 4; 1.3-a-1  
AR Extended 1.1-a-1, 2; 1.2-a-1, 2, 4  
NR Extended 2.1-a-2; 2.2-a-1  
GM 3.3-a-2  
GM Extended 3.2-a-3

Technology Education Framework Connection:

Content Standards  
Calculators: graphing utility

Required Activities (Common Experiences):

PH PRECALCULUS text, p. 636

Chapter Project I: Modeling Aircraft Motion - Students use vectors to represent the four aerodynamic forces, which act on an airplane in flight.

Suggested Activities: *Instructor's Resource Center (ICR)*

Chapter Project II: Project at Motorola - Signal Fades Due to Interference; complex trig functions are used to assure that a cellphone has optimal reception as a user travels up and down an elevator.

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator (TI-83 or TI-84)

PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, **Chapter 9 and 10**

Pacing:           Level 1: 7 days  
                          Level 2: 9 days

Notes to Teachers:  
SAT Study Guide

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Unit 9: Analytic Geometry

**Abstract**

In this unit students use a familiar formula, the distance formula, and rectangular coordinates to obtain equations for conics. Students will learn about the properties of circles, parabolas, ellipses, and hyperbolas and study their associated equations and graphs. The method used to study these conics is analytic geometry, a method which includes both algebra and geometry.

Essential Question: How do geometric relationships and measurements help us to solve problems and make sense of our world?

Focus Questions:

1. What are the four types of conics and what are their essential properties?
2. How are the equations of circles, parabolas, ellipses, and hyperbolas graphed?
3. What kind of real world scenarios use the equations of conics?

Benchmarks:

The student will be able to

1. identify the four basic conics and their equations
2. solve applications involving the basic conic equations

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-3; 1.2-a-1, 2, 3, 4; 1.3-a-1, 2  
AR Extended 1.1-a-1, 2, 3; 1.2-a-1, 2, 3; 1.3-a-1

Technology Education Framework Connection:  
Content Standards  
Calculators: graphing utility

Required Activities (Common Experiences):

PH PRECALCULUS text, p. 704

Chapter Project I: The Orbits of Neptune and Pluto - Students write and graph model (elliptical) equations for the orbits of Neptune and Pluto around the Sun.

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator (TI-83 or TI-84)

PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, **Chapter 10**

Pacing: Level 1: 5 days

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Unit 10: Sequences, Series, and the Binomial Theorem

**Abstract**

This unit begins with the study of the Sequence function, a function whose domain is the set of positive integers. Students will learn how to use summation notation and differentiate between arithmetic and geometric sequences. Next, the study of the Binomial Theorem builds on students' prior knowledge by formalizing a basic algebra expansion of  $(x+a)^2$ , to the expansion of  $(x+a)^n$  where  $n$  is any positive integer.

Essential Question:

How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? How do numbers represent quantitative relationships?

Focus Questions:

1. How is a numerical pattern evaluated to develop a sequence?
2. How is the sum of a sequence calculated algebraically and graphically?
3. What is the difference between arithmetic and geometric sequences?
4. How is the binomial theorem applied?

Benchmarks:

The student will be able to

1. develop the first several terms of a sequence
2. understand and use summation notation
3. determine if a sequence is arithmetic or geometric
4. use the binomial theorem to expand a power function

Connecticut Mathematics Curriculum Framework Connection:

AR 1.1-a-1  
AR Extended 1.1-a-1  
PS Extended 4.3-1-1

Technology Education Framework Connection:

Content Standards  
Calculators: graphing utility

Required Activities (Common Experiences):

PH PRECALCULUS text, p. 847

Chapter Project I: Population Growth - Using current population data, students derive a recursive function to predict U.S. population after  $n$  years.

Suggested Activities:

Assessment Tasks:

1. Required activities above.
2. Teacher generated tests and quizzes that align to unit benchmarks, focus questions and the essential question.

Instructional Resources and Materials:

Graphing Calculator (TI-83 or TI-84)  
PRECALCULUS: Enhanced with Graphing Utilities, Prentice Hall 2009, Chapter 12

Pacing: Level 1: 3 days

: