PISCATAWAY
TOWNSHIP SCHOOLS

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Topics in Pre-Calculus

Content Area: Mathematics
Grade Span: 11-12th grade
Revised by:
Presented by:
Approval date:

COURSE OVERVIEW

Description

Goals

Scope and Sequence		
Unit	**Topic**	**Length**
Unit 1	Linear Functions and Graphs	
Unit 2	Non-Linear Polynomial and Rational Functions	
Unit 3	Exponential and Logarithmic Functions	
Unit 4	Trigonometric Functions	
Unit 5	Analytical Trigonometry	
Unit 6	Trigonometric Applications	
Unit 7	Systems and Matrices	
Unit 8	Sequences and Series	
Unit 9	Limits and Continuity	

Resources
Core Text: **Suggested Resources:**

ALL UNITS: INSTRUCTIONAL FOCUS

Summary and Rationale

State Standards

Standard	
CPI #	**Cumulative Progress Indicator (CPI)**

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UNIT 1: Linear Functions and Graphs

Summary and Rationale

Recommended Pacing

State Standards	
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Instructional Focus
Unit Enduring Understandings
• Mathematics is based on patterns, relationships, and a defined set of rules that interconnect and explain all mathematical concepts and natural phenomena.   • Students will understand that graphing calculators and computer programs can be used across math disciplines to reinforce and extend curriculum and more efficiently execute computation

Unit Essential Questions
•   What is mathematics?   •   What is the purpose of technology?

Objectives
Students will know: •   General properties and behaviors of polynomial and non-linear functions.   •   Representations   •   Modeling and problem solving   **Students will be able to:**   •   Identify the domain and range   •   Finding slope of a line using various techniques   •   Graph using values, intercepts and slopes   •   Write equations from data or graphs   •   Illustrate and predict rates of change   •   Create scatter plots and identify/analyze lines of best fit
Resources
Core Text: **Suggested Resources:**

UNIT 2: Non-Linear Polynomial and Rational Functions

Summary and Rationale

Recommended Pacing

State Standards

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Instructional Focus

Unit Enduring Understandings

- Students will understand that there are a variety of methods to solve quadratic, polynomial, and rational equations.
- Students will understand that the number system evolves from natural numbers to imaginary numbers.
- Students will understand that graphing calculators and computer programs can be used across math disciplines to reinforce and extend curriculum and more efficiently execute computation

Unit Essential Questions
•   What is the best way to compute it?   •   Is math a language?   •   What is the purpose of technology?

Objectives
Students will know: •   General properties and behaviors of polynomial and non-linear functions.   •   Representations of non-linear functions.   **Students will be able to:**   •   Identify the vertex, maximums, minimums, domain, range, asymptotes, intercepts and zeros of functions.   •   Perform operations on complex numbers.   •   Apply the Fundamental Theorem of Algebra (to find the zeros of a polynomial)   •   Sketch the graphs of quadratic, polynomial and rational functions.   •   Explain the connection between intercepts and zeros of a function including imaginary solutions.

Resources
Core Text: **Suggested Resources:**

UNIT 3: Exponential and Logarithmic Functions

Summary and Rationale

Recommended Pacing

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Instructional Focus
Unit Enduring Understandings

- Mathematics is based on patterns, relationships and a defined set of rules that interconnect and explain all mathematical concepts and natural phenomena.
- Students will understand that graphing calculators and computer programs can be used across math disciplines to reinforce and extend curriculum and more efficiently execute computation.

Unit Essential Questions
• What is mathematics?
• What is the purpose of technology?

Objectives
Students will know:
• The properties of exponential and logarithmic functions.
• The difference between common and natural exponential and logarithmic functions.
• Interpret models to describe data
Students will be able to:
• Solve exponential and logarithmic equations (common and natural).
• Graph exponential and logarithmic function (common and natural).
• Simplify expressions with rational exponents.
• Calculate, describe and model growth and decay functions from real life data.
• Use calculators to better interpret and compare/explain data.

Resources
Core Text:
Suggested Resources:

UNIT 4: Trigonometric Functions

Summary and Rationale

Recommended Pacing

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Instructional Focus
Unit Enduring Understandings
• Students will understand that there is a relationship between the sides and angles of every triangle.   • Students will understand that graphing calculators and computer programs can be used across math disciplines to reinforce and extend curriculum and more efficiently execute computation.
Unit Essential Questions

| • | What is the best way to use geometry? |
| • | What is purpose of technology? |

Objectives

Students will know:
- Properties of right triangles
- The six trigonometric ratios and trigonometric applications
- Extension of angle measures to include negative angles
- Conversion between radian and degree measure
- Arc length
- Definitions of the trigonometric functions in terms of the unit circle
- Representations, behaviors and properties of trigonometric functions

Students will be able to:
- Apply the Pythagorean Theorem
- Solve special right triangles
- Determine the length of the unknown side of special right triangles
- Understand and evaluate the six trigonometric ratios using the right triangle and using a calculator.
- Find the angle of elevation and depression (indirect measurement) in real-world applications
- Find coterminal angles of a given angle in standard position
- Measure angles and arcs in degrees, radians, and degrees-minutes-seconds
- Solve problems involving arc length, linear velocity and angular velocity
- Understand and evaluate trig functions of an angle given a point on its terminal side
- Determine the signs (positive or negative) of the 6 trig functions in each of the four quadrants
- Use reference angles to find the exact values of trig functions
- Apply the properties of symmetry and periodicity to graph trig functions
- Recognize periodic functions, odd or even functions, and symmetric functions
- Sketch trig functions with/without graphing calculators
- Describe the characteristics of the graphs of the trig functions

Resources

Core Text:
Suggested Resources:

UNIT 5: Analytical Trigonometry

Summary and Rationale

Recommended Pacing

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Instructional Focus
Unit Enduring Understandings
• Students will understand that multiple methodologies can be used to solve a problem.
Unit Essential Questions

•   What is the most effective way to solve a problem? What is the best answer?

Objectives

Students will know:
- Fundamental trig identities
- Double angle identity, half angle identity, sum and difference identity, product to sum identity
- Solving trig equations

Students will be able to:
- Memorize and use the fundamental identities to prove other identities
- Use the fundamental identities to write equivalent trig expressions
- Use the "other identities" to write equivalent trig expressions and to evaluate given expressions.
- Solve trig equations by using identities
- Solve trig equations and find all solutions for a given interval

Resources

Core Text:
Suggested Resources:

UNIT 6: Trigonometric Applications

Summary and Rationale

Recommended Pacing

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Instructional Focus	
Unit Enduring Understandings	
• Students will understand that there is a relationship between the sides and angles of every triangle.	
Unit Essential Questions	

•	What is the best way to use geometry?

Objectives

Students will know:
- The Law of Sines and the Law of Cosines, and the area of a triangle
- The complex plane and polar form for complex numbers
- Vectors in the plane

Students will be able to:
- Apply the law of sines and the law of cosines, when appropriate, to solve a triangle, and find the missing parts of any triangle even if it is not a right triangle.
- Find the area of a triangle given the two sides and the included angle.
- Apply Heron's formula to find the area of a triangle when given three sides.
- To graph a complex number in the complex plane and to find the absolute value of a complex number
- To express a complex number in polar form
- Find the components and magnitude of a vector
- Perform scalar multiplication of vectors, vector addition and vector subtraction

Resources

Core Text:
Suggested Resources:

UNIT 7: Systems and Matrices

Summary and Rationale

Recommended Pacing

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Instructional Focus
Unit Enduring Understandings
• Students will understand that multiple methodologies can be used to solve a problem
Unit Essential Questions

•   What is the most effective way to solve a problem?

Objectives
Students will know: •   Multiple functions and their intersections •   Matrices **Students will be able to:** •   Graph linear and non-linear systems •   Solve linear systems algebraically with two or more variables. •   Use systems to solve real life situations. •   Describe the number of solutions in a non-linear system. •   Perform operations with matrices. •   Solve systems using matrices. •   Effectively use matrices to organize and simplify data. •   Understand why organization supports efficiency.

Resources
Core Text: **Suggested Resources:**

UNIT 8: Sequences and Series

Summary and Rationale

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Instructional Focus
Unit Enduring Understandings
• Students will understand that sequences can be described recursively and are present in nature and art.
Unit Essential Questions

•	What is mathematics?

Objectives

Students will know:
• Arithmetic and Geometric sequences
• Series
Students will be able to:
• Create terms of sequences.
• Write arithmetic and geometric sequence recursively and explicitly.
• Find the nth term of all types of sequences.
• Graph arithmetic and geometric sequences.
• Identify and explain the difference between arithmetic and geometric sequences.
• Understand and execute summation notation.
• Develop an informal notion of limits.

Resources

Core Text: **Suggested Resources:**

UNIT 9: Limits and Continuity

Summary and Rationale

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Instructional Focus
Unit Enduring Understandings

- Students will understand that problem solving is a process of analyzing the situation, selecting an appropriate method, implementing it, and evaluating the procedure and the results for reasonableness and the degree of accuracy.
- Students will understand that mathematics is based on patterns, relationships, and a defined set of rules that interconnect and explain all mathematical concepts and natural phenomena.

Unit Essential Questions
• What is the most effective way to solve a problem? What is the best answer?   • What is mathematics?

Objectives
Students will know: • Limits of a function   • Continuity   • Limits involving infinity   **Students will be able to:**   • Understand what happens to a function as it approached a given domain.   • Understand asymptotes and the continuity of functions.   • Use the properties of limits.   • Find the limits of polynomial and rational functions.   • Determine if a function is continuous at a point or on an interval.   • Apply properties of continuous functions.   • Define limits involving infinity.   • Use properties of limits at infinity.   • Use the Limit Theorem

Resources
Core Text: **Suggested Resources:**