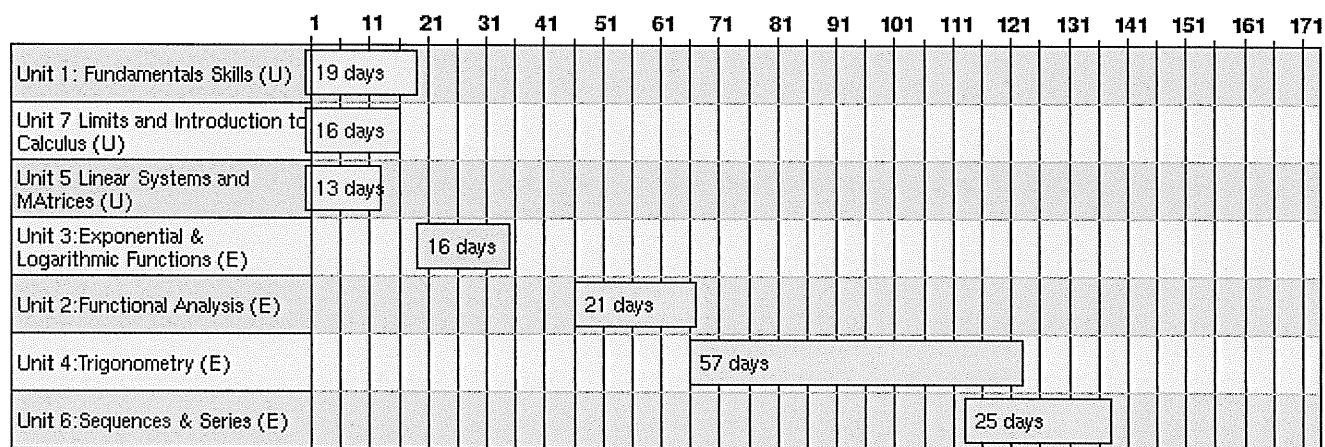


Folder: Mathematics

Group/District: PENNSYLVANIA

Course Map Timeline Pre-Calculus



☐ Essential (E)
 ☐ Important (I)
 ☐ Compact (C)
 ☐ Unranked (U)

Topic: Unit 1: Fundamentals Skills

Days: 19

Subject(s): Math

Grade(s): 10th, 11th, 12th

Key Learning: A strong foundation of fundamental algebraic skills is essential to understand higher level functional relationships.

Unit Essential Question(s):

What methods and strategies are used to solve equations and inequalities ? and What numbers and methods are used to represent the solutions?

Concept Solving Equations and Inequalities <u>2.2.11.F, 2.2.11.C, 2.5.11.A, 2.5.11.B, 2.5.11.C, 2.8.11.F, 2.8.11.G, 2.8.11.H, 2.8.11.I, 2.8.11.J, 2.8.11.K, 2.8.11.N</u>	Concept Functions/Inverse Functions <u>2.2.11.F, 2.5.11.B, 2.5.11.C</u>	Concept Combinations/Transformation <u>2.5.11.B, 2.5.11.C, 2.8.11.H</u>
Lesson Essential Question(s): What are the various methods of finding solutions to linear equations? (A) How do you find the slope of a line and the equation of that line? (A)	Lesson Essential Question(s): What are the domain and range of a function and how do they relate? (A) Describe the end behavior and critical points of an equation? (A) How do you find the inverse of a function algebraically and graphically? (A)	Lesson Essential Question(s): How do you perform arithmetic combinations of functions and/or compositions of functions? (A) Explain how rigid and non-rigid transformations affect a common graph (A)
Vocabulary: Quadratic equation, Discriminant, Polynomial, Graphic Solutions, Consistent, Dependent, Independent	Vocabulary: Vertical line test, Function, Domain, Range, Piecewise, Dependent, Independent, Relative maximum, Relative Minimum, Increasing Function, Decreasing Function, Constant Function, Greatest Integer Function, One-to-one, Horizontal Line Test	Vocabulary: Shifts, Reflections, x-axis, y-axis, vertical stretch/shrink, horizontal stretch/shrink, Arithmetic combination, Rigid, Non-rigid

Additional Information:

Attached Document(s):

Vocab Report for Topic: Unit 1: Fundamentals Skills

Days: 19

Subject(s): Math

Grade(s): 10th, 11th, 12th

Concept: Solving Equations and Inequalities

- Quadratic equation -
- Discriminant -
- Polynomial -
- Graphic Solutions -
- Consistent -
- Dependent -
- Independent -

Concept: Functions/Inverse Functions

- Vertical line test -
- Function -
- Domain -
- Range -
- Piecewise -
- Dependent -
- Independent -
- Relative maximum -
- Relative Minimum -
- Increasing Function -
- Decreasing Function -
- Constant Function -
- Greatest Integer Function -
- One-to-one -
- Horizontal Line Test -

Concept: Combinations/Transformation

- Shifts -
- Reflections -
- x-axis -
- y-axis -
- vertical stretch/shrink -
- horizontal stretch/shrink -
- Arithmetic combination -
- Rigid -
- Non-rigid -

Topic: Unit 2:Functional Analysis

Days: 21

Subject(s): Math

Grade(s): 11th, 12th

Key Learning: Understanding, and applying concepts of polynomial and rational functions will aid in sketching their graphs and using them to solve real life problems.

Unit Essential Question(s):

What methods can be used to analyze and apply the characteristics of polynomial and rational functions?

Concept Function Behavior <u>2.5.11.B, 2.8.11.J, 2.8.11.N, 2.8.11.O, 2.8.11.P, 2.8.11.S, 2.8.11.T, 2.11.11.A, 2.11.11.B</u>	Concept Polynomial & Rational Functions <u>2.1.11.A, 2.2.11.B, 2.2.11.F, 2.4.11.E, 2.5.11.A, 2.5.11.B, 2.5.11.C, 2.5.11.D, 2.8.11.D, 2.8.11.N, 2.8.11.O, 2.8.11.Q, 2.8.11.R, 2.8.11.S</u>	Concept Quadratic Functions
Lesson Essential Question(s): How do we determine the intervals on which a function is increasing or decreasing? (A) How do we locate the minimum and maximum values of a function? (A) How do we graph a function? (ET)	Lesson Essential Question(s): What means can be used to locate the zeros and roots of polynomial and rational functions? (A) What is the significance of the roots to a polynomial or rational function? (A) How do we perform basic operations with complex numbers? (A) What are the methods for finding complex roots to a polynomial? (A)	Lesson Essential Question(s): Where is the vertex and what is the end behavior of a quadratic function? (A) How do you calculate the zeroes of a function given a quadratic equation? (A) How do you convert from a general to standard form and vice-a-versa? (A)
Vocabulary: increasing, decreasing, positive and negative slope, extrema, tangent, secant, limit, local extrema, global extrema, restricting	Vocabulary: zeros, roots, intercepts, solutions, multiplicity, complex roots, real roots, rational roots, conjugate, complex numbers, imaginary numbers asymptotes and holes, types of discontinuity	Vocabulary: Zeroes of a function, Quadratic Equation, Discriminant, Complete the square, Complex number, Maximum, Minimum, Standard Form, Parabola, Axis of Symetry

Additional Information:

Algebraic Concepts: Understand and apply concepts, graphs, and applications of a variety of families of functions, including polynomial, exponential, logarithmic, logistic and trigonometric. Use appropriate functions to model real world situations and solve problems that arise from those situations.
 NO: Understand the nature and subsets of the real number system.

Attached Document(s):

Vocab Report for Topic: Unit 2:Functional Analysis

Days: 21

Subject(s): Math

Grade(s): 11th, 12th

Concept: Function Behavior

- increasing -
- decreasing -
- positive and negative slope -
- extrema -
- tangent -
- secant -
- limit -
- local extrema -
- global extrema -
- restricting -

Concept: Polynomial & Rational Functions

- zeros -
- roots -
- intercepts -
- solutions -
- multiplicity -
- complex roots -
- real roots -
- rational roots -
- conjugate -
- complex numbers -
- imaginary numbers asymptotes and holes -
- types of discontinuity -

Concept: Quadratic Functions

- Zeros of a function -
- Quadratic Equation -
- Discriminant -
- Complete the square -
- Complex number -
- Maximum -
- Minimum -
- Standard Form -
- Parabola -
- Axis of Symmetry -

Topic: Unit 3: Exponential & Logarithmic Functions

Subject(s): Math

Days: 16

Grade(s): 11th, 12th

Key Learning: Understanding, analyzing and applying concepts of exponential, logistic, and logarithmic functions is necessary to sketch their graphs and solve real life problems.

Unit Essential Question(s):

What are the characteristics and applications of exponential, logistic and logarithmic functions?

Concept: Exponential Functions <u>2.2.11.C</u>, <u>2.2.11.F</u>, <u>2.4.11.E</u>, <u>2.5.11.A</u>, <u>2.5.11.B</u>, <u>2.5.11.C</u>, <u>2.5.11.D</u>, <u>2.6.11.C</u>, <u>2.8.11.A</u>, <u>2.8.11.D</u>, <u>2.8.11.O</u>, <u>2.8.11.Q</u>, <u>2.8.11.R</u>, <u>2.8.11.S</u>, <u>2.8.11.T</u>, <u>2.11.11.A</u>, <u>2.11.11.B</u>, <u>2.11.11.C</u>, <u>M11.D.4.1.1</u>, <u>M11.D.3.1.1</u>	Concept: Logarithmic Functions <u>2.2.11.C</u>, <u>2.2.11.F</u>, <u>2.4.11.E</u>, <u>2.5.11.A</u>, <u>2.5.11.B</u>, <u>2.5.11.C</u>, <u>2.5.11.D</u>, <u>2.8.11.A</u>, <u>2.8.11.D</u>, <u>2.8.11.O</u>, <u>2.8.11.Q</u>, <u>2.8.11.R</u>, <u>2.8.11.S</u>, <u>2.8.11.T</u>, <u>2.11.11.A</u>, <u>2.11.11.B</u>, <u>2.11.11.C</u>, <u>M11.D.3.1.1</u>	Concept: Applications <u>2.11.11.A</u>, <u>2.11.11.C</u>, <u>2.5.11.A</u>, <u>2.5.11.B</u>, <u>2.5.11.D</u>, <u>2.5.11.C</u>
Lesson Essential Question(s): What are the characteristics and properties of exponential functions? (A) What is the relationship between the equation of an exponential function and its graph? (A)	Lesson Essential Question(s): What are the basic characteristics of logarithmic functions? (A) What is the relationship between the equation of a logarithmic function and its graph? (A) How can logarithmic functions be used to model various situations? (A) How can the properties of algebra be used to simplify and solve logarithmic expressions? (A)	Lesson Essential Question(s): How do you solve exponential and logarithmic equations? (A) How can exponential, logarithmic, logistic, and Gaussian functions be used to model real life situations? (A)
Vocabulary: exponential, lower bound, upper bound, growth, zero, root, x-intercepts, y-intercepts, decay, one-to-one, Continuous compounding	Vocabulary: logarithm, Change of Base formula, Inverse properties, Properties of logarithms	Vocabulary:

Additional Information:

Algebraic Concepts: Understand and apply concepts, graphs, and applications of a variety of families of functions, including polynomial, exponential, logarithmic, logistic and trigonometric. Use appropriate functions to model real world situations and solve problems that arise from those situations.

Attached Document(s):

Vocab Report for Topic: Unit 3:Exponential & Logarithmic Functions

Days: 16

Subject(s): Math

Grade(s): 11th, 12th

Concept: Exponential Functions

- exponential -
- lower bound -
- upper bound -
- growth -
- zero -
- root -
- x-intercepts -
- y-intercepts -
- decay -
- one-to-one -
- Continuous compounding -

Concept: Logarithmic Functions

- logarithm -
- Change of Base formula -
- Inverse properties -
- Properties of logarithms -

Topic: Unit 4: Trigonometry

Subject(s): Math

Days: 57

Grade(s): 11th, 12th

Key Learning: Understanding the concepts and graphs of trigonometric functions is needed to use them to solve problems. Understand and apply concepts, graphs, and applications of the family of trigonometric functions.

Unit Essential Question(s):

What are the trigonometric functions and how can they be applied to solve problems?

Concept: Definitions of the Trig Functions <u>2.2.11.F, 2.3.11.B, 2.4.11.E, 2.5.11.B, 2.5.11.C, 2.8.11.A, 2.8.11.E, 2.8.11.S, 2.8.11.T, 2.10.11.B, M11.C.1.1.2</u>	Concept: Graphs of Trig Functions <u>2.2.11.F, 2.8.11.A, 2.8.11.B, 2.8.11.C, 2.8.11.O, 2.8.11.Q, 2.8.11.R, 2.8.11.S, 2.8.11.T, 2.10.11.A</u>	Concept: Analytic Trigonometry <u>2.1.11.A, 2.4.11.E, 2.5.11.A, 2.5.11.B, 2.5.11.C, 2.5.11.D</u>
Lesson Essential Question(s): How can the measure of an angle be found and what units may be used to record its size? (A) What are the definitions of the various trigonometric functions? (A) What are the relationships between the right triangle and circular definitions of the trigonometric functions? (A) What are the relationships between angle measurements and arc length? (A)	Lesson Essential Question(s): What are the characteristics of the graphs of the six trigonometric functions (A) How do changes in the various fundamental characteristics (i.e. period, amplitude, phase displacement, etc.) affect the graph of a trigonometric function? (A) What are the inverses of the trigonometric functions? (A) How can trigonometric graphs be used in real life situations? (A)	Lesson Essential Question(s): What are the trigonometric identities? (A) How can we simplify trigonometric expressions? (A) How do we solve equations involving trigonometric functions using properties of algebra, trigonometric identities and inverse functions?? (ET) What are the inverses of trigonometric functions and how are they used? (A)
Vocabulary: standard position, coterminal angles, reference angles, arc length, degree-minute-second, radian, sine, cosine, tangent, cotangent, secant, cosecant, initial side, terminal side, unit circle, positive angle, negative angle, Linear speed, Angular speed, Even and Odd Trigonometric Functions, Angle of Elevation, Angle of Depression, A.S.T.C.	Vocabulary: amplitude, period, frequency, phase shift (displacement), periodic, harmonic motion, inverse, sinusoidal	Vocabulary: reciprocal identities, cofunction identities, pythagorean identities, sum and difference identities, half angle identities, double angle identities, Verify, Product to Sum Identity, Sum to Product Identity

Topic: Unit 4: Trigonometry

Subject(s): Math

Days: 57

Grade(s): 11th, 12th

Concept: Applications of Trigonometric Functions <u>2.2.11.F, 2.5.11.A, 2.5.11.B, 2.5.11.C, 2.5.11.D, 2.9.11.I, 2.10.11.B</u>	Concept: Trig and Polar Form of Complex Numbers <u>2.1.11.A, 2.8.11.B, 2.8.11.C, 2.10.11.A, 2.2.11.F</u>
Lesson Essential Question(s): How might right triangle trigonometry be used to model and solve problems of angle measure and length? (A) What is the Law of Sines and when can it be used to find missing sides and angles of a triangle? (ET) When is the Law of Cosines appropriate and how can it be used to find the lengths and/or measures of a triangle? (ET) What is Heron's Formula and how is it used? (ET)	Lesson Essential Question(s): How do you perform basic arithmetic concepts with Complex Numbers? (A) How do you find the nth power/nth root of a complex number? (A) How do you convert from polar to rectangular form and vice-a-versa? (A) Coordinate Conversion (A) (A)
Vocabulary: Law of Sines, Law of Cosines, Heron's Formula, Oblique Triangles, Ambiguous Case	Vocabulary: Absolute Value, modular, Argument, De'Moivre's Theorem, Polar Axis, Polar Coordinate System

Additional Information:

Algebraic Concepts: Understand and apply concepts, graphs, and applications of a variety of families of functions, including polynomial, exponential, logarithmic, logistic and trigonometric. Use appropriate functions to model real world situations and solve problems that arise from those situations.
 M: Use Laws of Sines and Cosines to solve problems dealing with the length of sides and measures of angles in triangles.

Attached Document(s):

Vocab Report for Topic: Unit 4:Trigonometry

Days: 57

Subject(s): Math

Grade(s): 11th, 12th

Concept: Definitions of the Trig Functions

- standard position -
- coterminal angles -
- reference angles -
- arc length -
- degree-minute-second -
- radian -
- sine -
- cosine -
- tangent -
- cotangent -
- secant -
- cosecant -
- initial side -
- terminal side -
- unit circle -
- positive angle -
- negative angle -
- Linear speed -
- Angular speed -
- Even and Odd Trigonometric Functions -
- Angle of Elevation -
- Angle of Depression -
- A.S.T.C. -

Concept: Graphs of Trig Functions

- amplitude -
- period -
- frequency -
- phase shift (displacement) -
- periodic -
- harmonic motion -
- inverse -
- sinusoidal -

Concept: Analytic Trigonometry

- reciprocal identities -
- cofunction identities -
- pythagorean identities -
- sum and difference identities -
- half angle identities -
- double angle identities -
- Verify -
- Product to Sum Identity -
- Sum to Product Identity -

Vocab Report for Topic: Unit 4: Trigonometry

Subject(s): Math

Days: 57

Grade(s): 11th, 12th

Concept: Applications of Trigonometric Functions

- Law of Sines -
- Law of Cosines -
- Heron's Formula -
- Oblique Triangles -
- Ambiguous Case -

Concept: Trig and Polar Form of Complex Numbers

- Absolute Value -
- modular -
- Argument -
- De'Moivre's Theorem -
- Polar Axis -
- Polar Coordinate System -

Topic: Unit 5 Linear Systems and Matrices

Subject(s): Math

Days: 13

Grade(s): 10th, 11th, 12th

Key Learning: Multiple Linear equations in multiple variables can be solved by various methods.



Unit Essential Question(s):

How are linear systems solved?

Concept:

Methods of Solving Linear Equations2.1.11.A, 2.5.11.B, 2.8.11.D, 2.8.11.F, 2.8.11.G, 2.8.11.H

Concept:

Matrix Operations2.8.11.E, 2.8.11.D

Lesson Essential Question(s):

How are systems of linear equations solved using substitution? (A)

How are systems of linear equations solved graphing? (A)

How are systems of linear equations solved using elimination? (A)

Lesson Essential Question(s):

How do you manipulate matrices using basic matrix operations? (A)

How do you find the determinant and inverse of a square matrix? (A)

Vocabulary:

System of equations, Point of intersection, Break even point, Equivalent systems, Consistent

Vocabulary:

Square determinant, inverse, Row matrix, Column Matrix, Row Echelon Form, Scale, Matrix Multiplication

Additional Information:

Attached Document(s):

Vocab Report for Topic: Unit 5 Linear Systems and Matrices

Subject(s): Math

Days: 13

Grade(s): 10th, 11th, 12th

Concept: Methods of Solving Linear Equations

- System of equations -
- Point of intersection -
- Break even point -
- Equivalent systems -
- Consistent -

Concept: Matrix Operations

- Square determinant -
- inverse -
- Row matrix -
- Column Matrix -
- Row Eschelon Form -
- Scale -
- Matrix Multiplication -

Topic: Unit 6: Sequences & Series

Days: 25

Subject(s): Math

Grade(s): 11th, 12th

Key Learning: Sequences and series are useful in modeling and solving real life problems.

Unit Essential Question(s):

How are sequences and series used to model and solve real life problems?

Concept Sequences <u>2.8.11.A, 2.8.11.B, 2.8.11.C, M11.E.3.1.1, M11.E.3.2.1</u>	Concept Series <u>2.8.11.A, 2.8.11.B, 2.8.11.C, 2.11.11.D</u>	Concept Applications <u>2.4.11.E, 2.5.11.A, 2.5.11.B, 2.5.11.C, 2.5.11.D, 2.7.11.A, 2.7.11.E, 2.8.11.A, 2.8.11.C, 2.11.11.D, M11.E.3.1.1, M11.E.3.2.1</u>
Lesson Essential Question(s): How do you recognize and describe arithmetic sequences? (A) How do you recognize and describe geometric sequences? (A) What other types of sequences are useful? (ET)	Lesson Essential Question(s): What is the relationship between sequences and series? (A) What series can be summed and how do you find the sum? (A)	Lesson Essential Question(s): How are sequences and series used to solve real life applications? (ET) What is the binomial theorem and how is it used? (A) How can sequences and series be used to solve counting and probability problems? (A) How are sequences and series used to solve real life applications? (ET) What is the binomial theorem and how is it used? (A) How can sequences and series be used to solve counting and probability problems? (A)
Vocabulary: arithmetic sequence, geometric sequence, harmonic sequence, recursion, recursion formula, infinite sequence, finite sequence, factorial, fibonacci, sequence, nth term formula, Common Difference/Ratio	Vocabulary: series, sum of series, summation notation, Infinite Series, Finite Series	Vocabulary: binomial theorem, probability, combinations, permutations, random, mutually exclusive, complement of an event, fundamental counting principal, experiment, sample space, odds, independent, binomial expansion, binomial coefficient, pascal's triangle, Distinguishable permutations, Union

Topic: Unit 6:Sequences & Series

Subject(s): Math

Days: 25

Grade(s): 11th, 12th

Concept:

Mathematical Inductions

2.4.11.A, 2.4.11.B, 2.4.11.C



Lesson Essential Question(s):

What is mathematical induction and how is it used in proofs? (ET)



Vocabulary:

mathematical induction, mathematical, induction

Additional Information:

Algebraic Concepts: Understand and apply concepts, graphs, and applications of a variety of families of functions, including polynomial, exponential, logarithmic, logistic and trigonometric. Use appropriate functions to model real world situations and solve problems that arise from those situations.

Data Analysis and Probability: Use a variety of techniques to "linearize data" by applying transformations to data to make linear regression more precise. Understand and use elementary probability functions and distributions to solve problems. DAP: Understand and use elementary probability functions and distributions to solve problems.

Attached Document(s):

Vocab Report for Topic: Unit 6:Sequences & Series

Subject(s): Math

Days: 25

Grade(s): 11th, 12th

Concept: Sequences

- arithmetic sequence -
- geometric sequence -
- harmonic sequence -
- recursion -
- recursion formula -
- infinite sequence -
- finite sequence -
- factorial -
- fibonacci -
- sequence -
- nth term formula -
- Common Difference/Ratio -

Concept: Series

- series -
- sum of series -
- summation notation -
- Infinite Series -
- Finite Series -

Concept: Applications

- binomial theorem -
- probability -
- combinations -
- permutations -
- random -
- mutually exclusive -
- complement of an event -
- fundamental counting principal -
- experiment -
- sample space -
- odds -
- independent -
- binomial expansion -
- binomial coefficient -
- pascal's triangle -
- Distinguishable permutations -
- Union -

Concept: Mathematical Inductions

- mathematical induction -
- mathematical -
- induction -

Vocab Report for Topic: Unit 6:Sequences & Series

Subject(s): Math

Days: 25

Grade(s): 11th, 12th

Topic: Unit 7 Limits and Introduction to Calculus
Subject(s):

Days: 16
Grade(s):

Key Learning: Functional behavior includes limits which is the basis for Calculus



Unit Essential Question(s):

What methods and strategies are used to find a limit?



Concept:

Limits

2.1.11.A, 2.5.11.B, 2.9.11.C, 2.8.11.J, 2.9.11.G

Concept:

Area and Application

2.1.11.A, 2.5.11.B, 2.9.11.G, 2.8.11.J



Lesson Essential Question(s):

How do you find the limit as x approaches finite term? (A)

How do you find a tangent line? (A)

How do you find the limit as x approaches infinity? (A)

Lesson Essential Question(s):

How do you find the area of a region bound by 2 vertical lines, x -axis, and a curve? (A)



Vocabulary:

Limit, Left/Right Behavior, Oscillating Behavior, Rationalization, Indeterminate Form, One-sided limit, Tangent line, Limits at infinity, Derivative, Converge

Vocabulary:

Area of a plane region

Additional Information:

Attached Document(s):

Vocab Report for Topic: Unit 7 Limits and Introduction to Calculus
Subject(s):

Days: 16
Grade(s):

Concept: Limits

- Limit -
- Left/Right Behavior -
- Oscillating Behavior -
- Rationalization -
- Indeterminate Form -
- One-sided limit -
- Tangent line -
- Limits at infinity -
- Derivative -
- Converge -

Concept: Area and Application

- Area of a plane region -