Georgia's K-12 Mathematics Standards Curriculum Map

Implementation beginning Fall 2023

PRECALCULUS & AP PRECALCULUS

PRECALCULUS & AP PRECALCULUS CURRICULUM MAP

Georgia's K-12 Mathematics Standards
PRECALCULUS & AP PRECALCULUS

Semester 1			Semester 2			
Unit 1	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**
Modeling with Rational and Piecewise-Defined Functions **AP Unit 1* Interdisciplinary Connection	Modeling with Trigonometric Expressions and Functions **AP Unit 3* Interdisciplinary Connection	Applying Trigonometric Identities and Equations **AP Unit 3* Interdisciplinary Connection	Modeling with Conic Sections and Polar Equations **AP Unit 3* Interdisciplinary Connection	Modeling with Vector Quantities **AP Unit 4* Interdisciplinary Connection	Modeling with Sequences and Series **AP Unit 4* Interdisciplinary Connection	Culminating Capstone Unit
Traditional Schedule						
4 – 5 weeks	**5 – 6 weeks**	**4 – 5 weeks**	**4 – 5 weeks**	**4 – 5 weeks**	**4 – 5 weeks**	**1 – 2 weeks**
Block Schedule						
12 – 15 days	**15 – 18 days**	**12 – 15 days**	**12 – 15 days**	**12 – 15 days**	**12 – 15 days**	**2 – 4 days**
PC.FGR.2 PC.MP.1-8 PC.MM.1	PC.FGR.3 PC.MP.1-8 PC.MM.1	PC.AGR.4 PC.MP.1-8 PC.MM.1	PC.GSR.5 PC.MP.1-8 PC.MM.1	PC.AGR.6 PC.MP.1-8 PC.MM.1	PC.PAR.7 PC.MP.1-8 PC.MM.1	ALL STANDARDS
Ongoing interdisciplinary learning to impact the community and to explain real-life phenomena.						
The concepts presented in each unit are presented based on a logical, mathematical progression. Each unique unit in sequence builds upon the previous unit.						
The Framework for Statistical Reasoning, Mathematical Modeling Framework, and the K-12 Mathematical Practices should be incorporated throughout all units.						

***NOTE: AP Precalculus concepts are embedded within Georgia Advanced Algebra: Concepts & Connections and Georgia Precalculus. Students who complete both courses will be eligible to take the AP Precalculus Exam. More details about the AP Precalculus Exam can be found on the College Board AP Central website. Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.**

Key for Course Standards: MP: Mathematical Practices, MM: Mathematical Modeling, FGR: Functional & Graphical Reasoning, AGR.4: Algebraic & Geometric Reasoning, GSR: Geometric & Spatial Reasoning, AGR.6: Algebraic & Graphical Reasoning, PAR: Patterning & Algebraic Reasoning

PRECALCULUS & AP PRECALCULUS

Year-At-A-Glance

Semester 1

Pacing Suggestion	Unit	Content Standards	Learning Objectives
Traditional 4 – 5 weeks **Block** 12 - 15 days	**Unit 1: Modeling with Rational and Piecewise-Defined Functions** *Students will reason abstractly and quantitatively while modeling contextual mathematical problems using rational and piecewise functions. This unit requires the development of attention to precision, notational fluency, and problem-solving perseverance. Students will extend prior solving and graphical analysis work with rational functions from Advanced Algebra to include division methods, analysis of extraneous solutions, and the use of limit notation to describe vertical and horizontal asymptotes. Students will utilize both interval notation and inequality notation. Work with one-sided limits, two-sided limits, and continuity will occur in graphical, numerical, and analytical situations. Analysis of absolute value functions will occur as piecewise-defined functions both algebraically and graphically. Students will analyze piecewise-defined functions graphically, numerically, and algebraically by building upon prior knowledge of functions. This work provides reinforcement of prior function study in the new piecewise context in order to increase proficiency and promote Calculus readiness.*	PC.FGR.2 PC.MP.1-8 PC.MM.1	PC.FGR.2.1 PC.FGR.2.2 PC.FGR.2.3 PC.FGR.2.4 PC.FGR.2.5 PC.FGR.2.6 PC.FGR.2.7 PC.FGR.2.8 PC.FGR.2.9 PC.MM.1.1-4
Traditional 5 – 6 weeks **Block** 15 - 18 days	**Unit 2: Modeling with Trigonometric Expressions and Functions** *In Advanced Algebra, students investigated radian measure conceptually and visually on a circle and developed the one counterclockwise revolution radian measures corresponding to reference angles of $\pi/6$, $\pi/4$, and $\pi/3$ through conversions from degrees. This unit will build the unit circle, connect radian measures to portions of 2π, work with radian measure not containing π, and utilize angles both in the clockwise and counterclockwise direction. Students will define the six trigonometric ratios in terms of x, y, and r using a circle centered at the origin of the coordinate plane and use the parametric interpretation of the coordinates on the unit circle as (cos(t), sin(t)). The six trigonometric functions will be developed and utilized for modeling periodic phenomena. Characteristics of the six trigonometric functions and their graphs will be investigated and used to classify these functions based on commonalities. These trigonometric relationships will be used to derive the fundamental trigonometric identities. This unit requires the development of attention to precision, notational fluency, and problem-solving perseverance as the trigonometric functions are used in a variety of contexts. The need to restrict the domain of each trigonometric function to develop its corresponding inverse function will be explored. The use of the inverse function will be related to prior inverse studies with restriction awareness developed for understanding subsequent contextual situations such as vectors, technology use, etc.*	PC.FGR.3 PC.MP.1-8 PC.MM.1	PC.FGR.3.1 PC.FGR.3.2 PC.FGR.3.3 PC.FGR.3.4 PC.FGR.3.5 PC.FGR.3.6 PC.FGR.3.7 PC.FGR.3.8 PC.MM.1.1-4

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Year-At-A-Glance

Semester 1 (continued)

Pacing Suggestion	Unit	Content Standards	Learning Objectives
Traditional 4 – 5 weeks **Block** 12 - 15 days	**Unit 3: Applying Trigonometric Identities and Equations** *This unit requires students to build upon their trigonometric knowledge and use the fundamental trigonometric identities to simplify expressions for easier application in contextual situations as well as to develop and verify new identities. Students will make use of structure, use abstract reasoning, and attend to precision in the development of the sum, difference, double-angle, and half-angle formulas for sine, cosine, and tangent. Identities will be used in problem solving situations and modeling contexts. The unit strengthens the development of notational fluency and problem-solving perseverance. Right triangular trigonometry is extended to oblique triangle situations using the Law of Sines, Law of Cosines, and Area Formula. These tools will be used strategically and appropriately in multiple and varied contextual situations.*	PC.AGR.4 PC.MP.1-8 PC.MM.1	PC.AGR.4.1 PC.AGR.4.2 PC.AGR.4.3 PC.AGR.4.4 PC.AGR.4.5 PC.MM.1.1-4

Semester 2

Pacing Suggestion	Unit	Content Standards	Learning Objectives
Traditional 4 – 5 weeks **Block** 12 - 15 days	**Unit 4: Modeling with Conic Sections and Polar Equations** *Students will contrast their prior study of functions with the algebraic study of implicit forms of conic sections. This unit requires the students to make use of structure, use abstract reasoning, and attend to precision when working with conic sections graphically and algebraically. Students will use the tool of completing the square to arrive at the standard form of a conic section. Work with implicit curves reinforces and develops concepts needed for future STEM field studies. The polar coordinate system will be defined and related to the rectangular coordinate system through appropriate conversions. Investigation of special polar equations, their application to contextual situations, and an appreciation for the simpler polar form will occur. The connection between the graph of a trigonometric function like $y = 3\cos(x)$ on a rectangular plane and its manifestation on the polar plane as $r = 3\cos(\theta)$ with a rotational input and radial distance output will be analyzed. This unit will require students to make sense of problems, develop perseverance, and strategically use appropriate tools.*	PC.GSR.5 PC.MP.1-8 PC.MM.1	PC.GSR.5.1 PC.GSR.5.2 PC.GSR.5.3 PC.GSR.5.4 PC.GSR.5.5 PC.MM.1.1-4

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Year-At-A-Glance

Semester 2

Pacing Suggestion	Unit	Content Standards	Learning Objectives
Traditional 4 – 5 weeks **Block** 12 - 15 days	**Unit 5: Modeling with Vector Quantities** *Application of trigonometry to modeling contextual mathematical problems with the use of vectors and parametric equations will require students to reason abstractly and quantitatively, make sense of problems, and attend to precision. Notational fluency with different vector representations and situations should be developed. Work with vectors in component form as well as magnitude and direction form and the articulation of each meaning as related to their geometric and graphical interpretation will occur. Vector operations and use of varied vector addition methods will be incorporated. This unit provides the opportunity to work with an abundance of contextual problems involving force, velocity, etc. Parametric equations will be articulated as models for the pathway of a moving object with appropriate indications of direction. Parametric equation sets of the unit 4 conic sections and their corresponding relationship to the Pythagorean identities will be explored. Application of parametric equations to model contextual situations and extensive work with vectors develops relevant knowledge for implementation in STEM college and career fields.*	PC.AGR.6 PC.MP.1-8 PC.MM.1	PC.AGR.6.1 PC.AGR.6.2 PC.AGR.6.3 PC.AGR.6.4 PC.AGR.6.5 PC.AGR.6.6 PC.MM.1.1-4
Traditional 4 – 5 weeks **Block** 12 - 15 days	**Unit 6: Modeling with Sequences and Series** *Articulation in the difference between a sequence and a series and working with them from a number sense perspective is critical for success in this unit. Sequences will be investigated graphically, numerically, and symbolically. Fluent work with sequences in contextual situations requires students to make sense of problems and attend to precision. The meaning of convergence and divergence of a sequence using technology and number sense will be explored. Divergence will be linked to non-convergence and to the meaning of the non-existence of a limit. Understanding a series as the sum of a sequence and the limit of its partial sums is crucial for students to fully explore. Series will be explored graphically, numerically, and symbolically. This unit requires the development of notational fluency and precision in thinking. Derivation of the sum formulas for both the finite geometric series and infinite geometric series will occur. Applying the finite and infinite geometric sum formulas to contextual modeling situations will require students to reason abstractly and quantitatively. Extensive work with sequences and series increases the development of number sense and provides foundational work of relevant knowledge needed in STEM college and career fields.*	PC.PAR.7 PC.MP.1-8 PC.MM.1	PC.PAR.7.1 PC.PAR.7.2 PC.PAR.7.3 PC.PAR.7.4 PC.PAR.7.5 PC.PAR.7.6 PC.PAR.7.7 PC.MM.1.1-4
Traditional 1 - 2 weeks **Block** 2 - 4 days	**Unit 7: Culminating Capstone Unit** ***(applying concepts in real-life contexts through a culminating interdisciplinary unit)*** *The capstone unit applies content that has already been learned in previous interdisciplinary PBLs and units throughout the school year. The capstone unit is an interdisciplinary unit that allows students to create a presentation, report, or demonstration that could include their models used to answer an overarching driving question. (e.g., Students can present their solution(s), findings, project, or answer to the driving question to a larger audience during the culminating capstone unit.)*	ALL STANDARDS PC.MP.1-8 PC.MM.1	ALL ASSOCIATED LEARNING OBJECTIVES

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Semester 1

Unit 1: Modeling with Rational and Piecewise-Defined Functions

Traditional (4 - 5 weeks)	Block (12 - 15 days)

Big Ideas: Functional & Graphical Reasoning and Mathematical Modeling

Standards Addressed in this Unit:

PC.FGR.2: Analyze the behaviors of rational and piecewise functions to model contextual mathematical problems.

PC.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Suggested Clusters of Concepts (Learning Objectives)		***Evidence of Student Learning***
PC.FGR.2.1	Graph piecewise-defined functions, including step functions and absolute value functions.	Fundamentals • Students should be able to model real-life problems with piecewise-defined functions that incorporate linear, polynomial, logarithmic, exponential, and radical functions.
PC.FGR.2.2	Describe characteristics by interpreting the algebraic form and graph of a piecewise-defined function.	Strategies and Methods • Students should be able to identify characteristics including domain, range, continuity, end behavior, intercepts, and intervals of increase and decrease.
PC.FGR.2.3	Represent the limit of a function using both the informal definition and the graphical interpretation in the context of piecewise-defined functions; interpret limits expressed in analytic notation.	Fundamentals • Students should be able to determine if a limit exists or not and use appropriate limit notation. • Students should have opportunities to use one-sided limits to investigate continuity at a point.

		• Students are not expected to know nor derive the formal definition of a limit.
PC.FGR.2.4	Divide polynomials using various methods.	Strategies and Methods • Students should be provided opportunities with factoring and simplification, long division, and synthetic division. Fundamentals • Students should be able to connect the Remainder Theorem and Factor Theorem to the division process.
PC.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
PC.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
PC.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
PC.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Semester 1

Unit 1 *(continued)*: Modeling with Rational and Piecewise Functions

Traditional (4 - 5 weeks)	Block (12 - 15 days)

Big Ideas: Functional & Graphical Reasoning and Mathematical Modeling

Standards Addressed in this Unit:

PC.FGR.2: Analyze the behaviors of rational and piecewise functions to model contextual mathematical problems.

PC.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Suggested Clusters of Concepts (Learning Objectives)		*Evidence of Student Learning*
PC.FGR.2.5	Graph rational functions and identify key characteristics.	Fundamentals • Students should have gained experience graphing and analyzing rational functions in the Advanced Algebra course. Strategies and Methods • Students should have opportunities to graph rational functions with and without the use of technology. • Students should be able to identify characteristics including zeros, asymptotes, domain, range, intercepts, intervals of increase and decrease, relative extrema, symmetries, discontinuities, and end behavior. • Students should be proficient using both interval and inequality notation to report key characteristics.

PC.FGR.2.6	Represent the behavior of a rational function using limit notation for vertical and horizontal asymptotes and end behavior.	Examples • $\lim_{x\to 3^-} \frac{x-1}{x-3}$ for vertical asymptote. • $\lim_{x\to\infty} \frac{x-1}{x-3}$ for horizontal asymptote (end behavior). • $\lim_{x\to\infty} \frac{x^2-1}{x-3}$ for end behavior.
PC.FGR.2.7	Represent the limit of a function using both the informal definition and the graphical interpretation in the context of rational functions; interpret limits expressed in analytic notation.	Fundamentals • Students are not expected to know nor derive the formal definition of a limit.
PC.FGR.2.8	Solve simple rational equations in one variable and give examples showing how extraneous solutions may arise.	
PC.FGR.2.9	Perform partial fraction decomposition of rational functions using non-repeated linear factors.	Relevance and Application • This is a relevant prerequisite skill for students intending to explore concepts of Calculus more deeply.
PC.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
PC.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
PC.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
PC.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

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Unit 2: Modeling with Trigonometric Expressions and Functions

Traditional (5 - 6 weeks)	Block (15 - 18 days)

Big Ideas: Functional & Graphical Reasoning and Mathematical Modeling

Standards Addressed in this Unit:

PC.FGR.3: Utilize trigonometric expressions to solve problems and model periodic phenomena with trigonometric functions.

PC.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Learning Objectives		*Evidence of Student Learning*
PC.FGR.3.1	Use the concept of a radian as the ratio of the arc length to the radius of a circle to establish the existence of 2π radians in one revolution.	Fundamentals • Students explored radian measures in Advanced Algebra and will build upon their understanding of radians with this learning objective. • Students should be able to fluently convert between degree and radian measures. • Students should be given the opportunity to develop the radian measure of the quadrantal angles. • Students should have opportunities to work with radian measures that are in terms of π and those not in terms of π.
PC.FGR.3.2	Utilize right triangles on the unit circle to determine the values of the six trigonometric ratios for $\pi/6$, $\pi/4$, and $\pi/3$. Use reflections of the triangles as reference angles to establish known values in all four quadrants of the coordinate plane.	Fundamentals • Students utilized radian measures corresponding to reference angles $\pi/6$, $\pi/4$, and $\pi/3$ in one counterclockwise revolution in Advanced Algebra through conversions from degrees. • Students should connect the radian angle names on the 17-point unit circle to portions of 2π radians.
PC.FGR.3.3	Define the six trigonometric ratios in terms of x, y, and r using the unit circle centered at the origin of the coordinate plane. Interpret radian measures of angles as a rotation both counterclockwise and clockwise around the unit circle.	Strategies and Methods • Students should utilize the parametric interpretation of the coordinates on the unit circle as (cos(t), sin(t)).

PC.FGR.3.4	Derive the fundamental trigonometric identities.	Fundamentals • Students should be able to derive the fundamental trigonometric identities, including the quotient, reciprocal, and Pythagorean identities.
PC.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
PC.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
PC.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
PC.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Unit 2 *(continued)*: Modeling with Trigonometric Expressions and Functions	
Traditional (5 - 6 weeks)	**Block (15 - 18 days)**
Big Ideas: Functional & Graphical Reasoning and Mathematical Modeling	

Standards Addressed in this Unit:

PC.FGR.3: Utilize trigonometric expressions to solve problems and model periodic phenomena with trigonometric functions.

PC.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Learning Objectives		***Evidence of Student Learning***
PC.FGR.3.5	Determine the value(s) of trigonometric functions for a set of given conditions.	Examples • Given a point on the terminal side of an angle in standard position, students should be able to give the exact value of the six trigonometric functions. • Given one trigonometric ratio and the quadrant for the terminal side of an angle, students should be able to give the exact value of the other five trigonometric functions. • Given two trigonometric ratios, students should be able to give the other four trigonometric functions.
PC.FGR.3.6	Graph and write equations of trigonometric functions using period, phase shift, and amplitude in modeling contexts.	Strategies and Methods • Students should be given opportunities to graph with and without the use of technology. • Students should have the opportunity to construct equations for contexts such as a Ferris Wheel ride, pendulum motion, tides, predator-prey models, sound waves, etc.
PC.FGR.3.7	Classify the six trigonometric functions as even or odd and describe the symmetry.	Strategies and Methods • Students should investigate the properties of the six trigonometric functions using the unit circle and the graphical representations of the trigonometric functions.

PC.FGR.3.8	Restrict the domain of a trigonometric function to create an invertible function and graph the inverse function. Evaluate inverse trigonometric expressions.	Strategies and Methods • Students should relate the characteristics of inverse trigonometric functions to output values given with and without the use of technology.
PC.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
PC.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
PC.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
PC.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Unit 3: Applying Trigonometric Identities and Equations

Traditional (4 - 5 weeks)	Block (12 - 15 days)

Big Ideas: Algebraic & Geometric Reasoning and Mathematical Modeling

Standards Addressed in this Unit:

PC.AGR.4: Manipulate, prove, and apply trigonometric identities and equations to solve contextual mathematical problems.

PC.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Learning Objectives		*Evidence of Student Learning*
PC.AGR.4.1	Apply the fundamental trigonometric identities to simplify expressions and verify other identities.	Fundamentals • Students should be able to use the quotient, reciprocal, and Pythagorean identities.
PC.AGR.4.2	Use sum, difference, double-angle, and half-angle formulas for sine, cosine, and tangent to establish other identities and apply them to solve problems.	Relevance and Application • Students should investigate the connections between the identities as they are derived.
PC.AGR.4.3	Solve trigonometric equations arising in modeling contexts.	Strategies and Methods • Students should extend their understanding of solving trigonometric equations on one counterclockwise revolution of the unit circle from Advanced Algebra. • Students should be given opportunities to represent solutions using the general solution, on a given interval, exact values from the unit circle, and ones obtained with technology. • Students should be given opportunities to investigate the visual idea that solving sin(x) = ½ finds the graphical intersection of y = sin(x) and y = ½. • Students should have the opportunity to investigate contexts such as a Ferris Wheel ride, pendulum motion, tides, predator-prey models, sound waves, etc. • Students should have the opportunity to solve trigonometric equations using algebraic techniques such as factoring, root methods, etc.

PC.AGR.4.4	Prove and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles.	Relevance and Application • Students should have the opportunity to investigate surveying problems, resultant forces, etc.
PC.AGR.4.5	Determine the area of an oblique triangle.	Strategies and Methods • Students should use trigonometric area formulas or Heron's Formula.
PC.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
PC.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
PC.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
PC.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Semester 2

Unit 4: Modeling with Conic Sections and Polar Equations

Traditional (4 - 5 weeks)	Block (12 - 15 days)

Big Ideas: Geometric & Spatial Reasoning and Mathematical Modeling

Standards Addressed in this Unit:

PC.GSR.5: Analyze the behaviors of conic sections and polar equations to model contextual mathematical problems.

PC.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Learning Objectives		*Evidence of Student Learning*
PC.GSR.5.1	Identify and graph different conic sections given the equations in standard form.	Relevance and Application • Students should explore circles, parabolas, ellipses, and hyperbolas.
PC.GSR.5.2	Identify different conic sections in general form and complete the square to convert the equation of a conic section into standard form.	Relevance and Application • Students should explore contexts like orbital paths, whispering galleries, satellite dish, nuclear cooling tower, parabolic hot dog cooker, etc.
PC.GSR.5.3	Define polar coordinates and relate polar coordinates to Cartesian coordinates.	Strategies and Methods • Students should be able to connect the trigonometric function in the Cartesian Plane to the corresponding polar function in the Polar Plane.
PC.GSR.5.4	Classify special polar equations and apply to contextual situations.	Relevance and Application • Students should investigate circles, cardioids, limaçons, and rose curves. Example • Students are able to explore and explain the connection to cardioid microphone sound patterns.

PC.GSR.5.5	Graph equations in the polar coordinate plane with and without the use of technology.	Relevance and Application • Students should be able to graph the trigonometric function in the Cartesian Plane using the corresponding polar function in the Polar Plane.
PC.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
PC.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
PC.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
PC.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Unit 5: Modeling with Vector Quantities

Traditional (4 - 5 weeks)	Block (12 - 15 days)

Big Ideas: Algebraic & Graphical Reasoning and Mathematical Modeling

Standards Addressed in this Unit:

PC.AGR.6: Represent and model vector quantities to solve problems in contextual situations.

PC.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Learning Objectives		*Evidence of Student Learning*
PC.AGR.6.1	Represent vector quantities as directed line segments; represent magnitude and direction of vectors in component form using appropriate mathematical notation.	Fundamentals • Students should be able to use appropriate and varied symbols for vectors and their magnitudes.
PC.AGR.6.2	Add and subtract vectors and multiply vectors by a scalar to find the resultant vector.	Fundaments • Students should be able to perform operations with vectors to find the resultant vector that solves a real-life problem.
PC.AGR.6.3	Add and subtract vectors on a coordinate plane using different methods.	Strategies and Methods • Students should explore, understand, and explain tail-to-head, component-wise, and the parallelogram law of vector addition.
PC.AGR.6.4	Solve contextual vector problems, such as those involving velocity, force, and other quantities.	
PC.AGR.6.5	Sketch the graph of a curve represented parametrically, indicating the direction of motion.	Relevance and Application • Students should be able to graph a pathway like $x(t)=3t$ and $y(t) = t^2 + 5$ that is traced from left to right as t increases and a pathway like $x(t)=-3t$ and $y(t) = t^2 + 5$ that is traced from right to left as t increases.
PC.AGR.6.6	Apply parametric equations to contextual problems.	Strategies and Methods • Students should identify, represent, and graph circles, ellipses, and hyperbolas in parametric form.

		Examples • Students should explore situations like the position on a Ferris Wheel, movement along a curve in the Cartesian Plane, projectile motion, etc.
PC.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
PC.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
PC.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
PC.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Unit 6: Modeling with Sequences and Series

Traditional (4 - 5 weeks)	Block (12 - 15 days)

Big Ideas: Patterning & Algebraic Reasoning and Mathematical Modeling

Standards Addressed in this Unit:

PC.PAR.7: Demonstrate how sequences and series apply to mathematical models in real-life situations.

PC.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics.

Suggested Clusters of Concepts (Learning Objectives)		*Evidence of Student Learning*
PC.PAR.7.1	Demonstrate that sequences are functions whose domain is the set of natural numbers.	
PC.PAR.7.2	Represent sequences graphically, numerically, and symbolically.	Strategies and Methods • Students should be able to fluently work with representations that are presented numerically, analytically or algebraically, symbolically, and graphically.
PC.PAR.7.3	Determine the limit of a sequence if it exists.	Strategies and Methods • Students should check for convergence or divergence with and without the use of technology.
PC.PAR.7.4	Demonstrate that a series is the sum of the sequence and represent series graphically, numerically, and symbolically.	Fundamentals • Students should be able to use sigma notation.
PC.PAR.7.5	Describe the behavior of a series in terms of the limit of its partial sums.	Relevance and Application • Students should explore the partial sums using technology. • Students should correctly use limit notation to represent the convergence of the partial sums.
PC.PAR.7.6	Derive and use the sum formula of a finite geometric series to solve contextual problems to model real-life situations.	
PC.PAR.7.7	Derive and use the sum formula of an infinite geometric series to solve contextual problems to model real-life situations.	Strategies and Methods • Students should have opportunities to check for convergence or divergence with and without the use of technology.
PC.MM.1.1	Explain contextual, mathematical problems using a mathematical model.	Fundamentals • Students should be provided with opportunities to learn mathematics in the

		context of real-life problems. • Contextual, mathematical problems are mathematical problems presented in context where the context makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).
PC.MM.1.2	Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts.	Fundamentals • Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.
PC.MM.1.3	Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation.	
PC.MM.1.4	Use various mathematical representations and structures with this information to represent and solve real-life problems.	

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.

PRECALCULUS & AP PRECALCULUS

Unit 7: Culminating Capstone Unit *(applying concepts in real-life contexts through a culminating interdisciplinary unit)*	
Traditional (1 - 2 weeks)	**Block (2 - 4 days)**
ALL standards are addressed in this unit. ***The capstone unit applies content that has already been learned in previous interdisciplinary PBLs and units throughout the school year. The capstone unit is an interdisciplinary unit that allows students to create a presentation, report, or demonstration that could include their models used to answer an overarching driving question. (e.g., Students can present their solution(s), findings, project, or answer to the driving question to a larger audience during the culminating capstone unit.)***	

Mathematical Practices (PC.MP.1- 8) should be evidenced at some point throughout each unit depending on the tasks that are explored. It is important to note that MPs 1, 3 and 6 should support the learning in every lesson.