Marietta City Schools

2024–2025 District Unit Planner

Enhanced Advanced Algebra & AP Precalculus

Unit title	Unit 5: Modeling Trigonometry, the Unit Circle, and Polar Functions (DOE Units 5 and 6)	**Unit duration (hours)**	*25 - 30 hours*

Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): ***What will students learn?***

GA DoE Standards
AP 3.1 - 3.15 **3.1 Periodic Phenomena** **3.2 Sine, Cosine, and Tangent** **3.3 Sine and Cosine Function Values** **3.4 Sine and Cosine Function Graphs** **3.5 Sinusoidal Functions** **3.6 Sinusoidal Function Transformations** **3.7 Sinusoidal Function Context and Data Modeling** **3.8 The Tangent Function** **3.9 Inverse Trigonometric Function** **3.10 Trigonometric Equations and Inequalities** **3.11 The Secant, Cosecant, and Cotangent Functions** **3.12 Equivalent Representations of Trigonometric Functions** **3.13 Trigonometry and Polar Coordinates** **3.14 Polar Function Graphs** **3.15 Rates of Change in Polar Functions** **AA.GSR.7:** Develop an introductory understanding of the unit circle; solve trigonometric equations using the unit circle. **AA.GSR.7.1** Define the three basic trigonometric ratios in terms of x, y, and r using the unit circle centered at the origin of the coordinate plane. **AA.GSR.7.2** Apply understanding of the angle measures and coordinates of the unit circle to solve practical, real-life problems involving trigonometric equations.

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

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.

PC.FGR.3.2 Utilize right triangles on the unit circle to determine the values of the six trigonometric ratios for π 6 , π 4 , and π 3 . Use reflections of the triangles as reference angles to establish known values in all four quadrants of the coordinate plane.

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.

PC.FGR.3.4 Derive the fundamental trigonometric identities.

PC.FGR.3.5 Determine the value(s) of trigonometric functions for a set of given conditions.

PC.FGR.3.6 Graph and write equations of trigonometric functions using period, phase shift, and amplitude in modeling contexts.

PC.FGR.3.7 Classify the six trigonometric functions as even or odd and describe the symmetry.

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.

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

PC.AGR.4.1 Apply the fundamental trigonometric identities to simplify expressions and verify other 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.

PC.AGR.4.3 Solve trigonometric equations arising in modeling contexts.

PC.4GR.4.4 Prove and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles.

PC.AGR.4.5 Determine the area of an oblique triangle.

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

PC.GSR.5.3 Define polar coordinates and relate polar coordinates to Cartesian coordinates.

PC.GSR.5.4 Classify special polar equations and apply to contextual situations.

PC.GSR.5.5 Graph equations in the polar coordinate plane with and without the use of technology.

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

<u>Concepts/Skills to be Mastered by Students</u>

- Understanding the unit circle concept and its properties.
- Proficiency in calculating and interpreting sine, cosine, and tangent ratios on the unit circle.
- Application of trigonometric equations and concepts to solve real-life problems.
- Mastery of the relationship between angle measures and coordinates on the unit circle.
- Ability to use the unit circle to solve trigonometric equations algebraically and graphically.

1.A Solve equations and inequalities represented analytically, with and without technology.
1.B Express functions, equations, or expressions in analytically equivalent forms that are useful in a given mathematical or applied context.
1.C Construct new functions, using transformations, compositions, inverses, or regressions, that may be useful in modeling contexts, criteria, or data, with and without technology.
2.A Identify information from graphical, numerical, analytical, and verbal representations to answer a question or construct a model, with and without technology.
2.B Construct equivalent graphical, numerical, analytical, and verbal representations of functions that are useful in a given mathematical or applied context, with and without technology.
3.A Describe the characteristics of a function with varying levels of precision, depending on the function representation and available mathematical tools.

3.B Apply numerical results in a given mathematical or applied context.
3.C Support conclusions or choices with a logical rationale or appropriate data.

Vocabulary

Parametric Equation, Radian Measure, Quadrantal Angle, Coterminal Angles, Inverse Function, Even Function, Odd Function, Sinusoidal, Transformation Features (midline, amplitude, vertical shift, vertical stretch, phase shift, period, and input-coefficient), Ambiguous Case, Identity, Law of Cosines, Law of Sines, Polar Coordinate System

Notation

sin(θ): Sine function, representing the ratio of the length of the opposite side to the length of the hypotenuse in a right triangle.
cos(θ): Cosine function, representing the ratio of the length of the adjacent side to the length of the hypotenuse in a right triangle.
tan(θ): Tangent function, representing the ratio of the length of the opposite side to the length of the adjacent side in a right triangle.
(x,y): Coordinates of a point on the unit circle, where x is the cosine of the angle and y is the sine of the angle.
r: Radius of the unit circle, typically equal to 1 unit.
θ: Angle measure, often represented in radians or degrees.

Essential Questions

How do we model aspects of circular and spinning objects without using complex equations from the x-y rectangular-based coordinate system?

What is the unit circle, and how does it relate to trigonometric functions?

How are the coordinates (x, y) of points on the unit circle related to the angle measure (θ) in radians or degrees?

How can understanding the unit circle help in solving trigonometric equations?

What are the limitations of trigonometric solutions in practical applications, and how can these limitations be addressed?

Assessment Tasks

List of common formative and summative assessments.

Formative Assessment(s):

Unit Skill Checks

AP Progress Checks

Summative Assessment(s):

Unit 5 Mid-unit Test

Unit 5 Cumulative Test

Learning Experiences

Add additional rows below as needed.

Objective or Content	Learning Experiences	Personalized Learning and Differentiation All information included by PLC in the differentiation box is the responsibility and ownership of the local school to review and approve per Board Policy IKB.
AP Topics: **3.13 Trigonometry and Polar Coordinates** **3.14 Polar Function Graphs** **PC.GSR.5** **PC.GSR.5.3** **PC.GSR.5.4** **PC.GSR.5.5**	Polar Exploration and Graphing Desmos Task Link: https://teacher.desmos.com/activitybuilder/custom/6615e4d6b7d287d3f9e3ca94 In this learning task, students will discover patterns of graphing polar functions and determine transformations of polar functions. Learning Goals: ● I can graph points on a polar coordinate grid. ● I can identify multiple ways to name a point on a polar coordinate grid. ● I can identify the difference between sine and cosine polar graphs. ● I can determine transformations of polar functions on a coordinate grid.	Students will work through the activity in differentiated groups, with whole-class check ins. Scaffolded questions and guidance will be given throughout class. Extension questions will be provided for excelling students.

Content Resources

Math Medic

AP Classroom

Bryan Passwater Notes

Textbook Correlation: enVision A|G|A - Algebra 2

AA.GSR.7.1 - Lessons 7-2
AA.GSR.7.2 - Lessons 7-2, 7-3