Marietta City Schools **2025–2026 District Unit Planner**	

Enhanced Advanced Algebra & AP Precalculus

Unit title	Unit 5: Functions Involving Parameters, Conics, Vectors, and Matrices (DOE Units 3, 6, and 7)	**Unit duration (hours)**	*7.5 hours*

GA DoE Standards
<u>Standards</u> **AP 4.1 - 4.14** **4.1 Parametric Functions** **4.2 Parametric Functions Modeling Planar Motion** **4.3 Parametric Functions and Rates of Change** **4.4 Parametrically Defined Circles and Lines** **4.5 Implicitly Defined Functions** **4.6 Conic Sections** **4.7 Parametrization of Implicitly Defined Functions** **4.8 Vectors** **4.9 Vector-Valued Functions** **4.10 Matrices** **4.11 The Inverse and Determinant of a Matrix** **4.12 Linear Transformations and Matrices** **4.13 Matrices as Functions** **4.14 Matrices Modeling Contexts** **AA.PAR.6:** Represent data with matrices, perform mathematical operations, and solve systems of linear equations leading to real-world linear programming applications. **AA.PAR.6.1:** Use matrices to represent data, and perform mathematical operations with matrices and scalars, demonstrating that some properties of real numbers hold for matrices, but that others do not.

AA.PAR.6.2: Rewrite a system of linear equations using a matrix representation.
AA.PAR.6.3: Use the inverse of an invertible matrix to solve systems of linear equations.
AA.PAR.6.4: Utilize linear programming to represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as solutions or non-solutions under the established constraints in real-world problems.

PC.AGR.6: Represent and model vector quantities to solve problems in contextual situations.
PC.AGR.6.1: Represent vector quantities as directed line segments; represent magnitude and direction of vectors in component form using appropriate mathematical notation.
PC.AGR.6.2: Add and subtract vectors and multiply vectors by a scalar to find the resultant vector.
PC.AGR.6.3: Add and subtract vectors on a coordinate plane using different methods.
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.
PC.AGR.6.6: Apply parametric equations to contextual problems.

PC.GSR.5: Analyze the behaviors of conic sections and polar equations to model contextual mathematical problems.
PC.GSR.5.1: Identify and graph different conic sections given the equations in standard form.
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.

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

Concepts/Skills to be Mastered by Students

- Mastery of matrix operations: addition, subtraction, scalar multiplication, and matrix multiplication.
- Ability to rewrite systems of linear equations as matrix equations and vice versa.
- Proficiency in finding the inverse of a matrix and using it to solve systems of equations.
- Understanding linear programming basics: objective functions, decision variables, and constraints.
- Application of mathematical concepts to real-world problems, including data interpretation and problem-solving within constraints.
- Students should know key characteristics of circles, parabolas, ellipses, and hyperbolas.
- Students should connect conics to contexts like orbital paths, whispering galleries, satellite dish, nuclear cooling tower, parabolic hot dog cooker, etc.
- Students should use vector operations to solve real-world problems
- Students should be able to complete math operations with vectors

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

Associative, Commutative, Column, Consistent System, Constraint, Decision Variable, Determinant (|A|), Diagonal of a Matrix, Extreme Point, Feasible Region, Identity, Identity Matrix, Inconsistent System, Inverse, Inverse of a Matrix, Invertible Matrix, Line, Linear Function, Linear Programming, Mapping, Matrix, Matrix Dimensions, Objective Function, Plane, Reduced Row Echelon Form, Row, Scalar, Systems of Equations, Scalar Multiplication, Transpose, Vector, Vector Space, Zero Matrix

Notation

$v = < a, b >$, $||v||$

Matrices are often represented using uppercase bold letters, such as A,B,C.
Scalar multiplication involves multiplying a scalar by each element of a matrix, commonly denoted as kA, where k is the scalar and A is the matrix.
[A]+[B] or A + B, for all operations.

Essential Questions

- How are vectors and scalars similar and different?
- How can I use vector operations to model, solve, and interpret real-world problems?
- How can I represent addition, subtraction, and scalar multiplication of vectors geometrically?
- How do geometric interpretations of addition, subtraction, and scalar multiplication of vectors help me perform computations efficiently?
- What are some different ways to add two vectors, and how are these representations related?
- How can matrices be utilized to represent datasets, and what mathematical operations are performed with matrices and scalars?
- In what ways do matrices exhibit similarities and differences compared to real numbers, and how do these properties impact mathematical operations?
- How can a system of linear equations be transformed into a matrix representation, and what advantages does this provide for solving such systems?
- What role does the inverse of an invertible matrix play in solving systems of linear equations, and how is it utilized effectively?
- What is linear programming, and how does it enable the representation of constraints in terms of equations or inequalities?
- In what ways can linear algebraic concepts and linear programming techniques be applied to real-world scenarios, and what insights do they provide for problem-solving and decision-making processes?

Assessment Tasks

List of common formative and summative assessments.

Formative Assessment(s): Unit Skill Checks **Summative Assessment(s):** Unit 5 Test

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

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.
AA.PAR.6.1 **AP 4.10 - 4.14**	**Organizing Matrices** In this learning plan, students will be introduced to matrices as tools for organizing and storing information. Students will explore a fundraising project where they will analyze cost of materials, time to produce each item, inventory, etc. Dimensions and dimension labels are used to provide rationale for addition and multiplication procedures. Emphasis is placed on interpreting entries as matrices are written, added, multiplied (scalar and regular) and transposed. **Learning Goal(s)** 1. I can represent data in matrix form and determine the dimensions of matrices. 2. I can add and subtract matrices and know when these operations are possible. 3. I can perform scalar multiplication on matrices. 4. I can multiply matrices and know when matrix multiplication is defined. 5. I can solve problems using matrix operations.	Students will be able to work at their own pace in collaborative groups where additional scaffolding is available as needed. Use of technology - graphing calculators and desmos

Content Resources
Math Medic **AP Classroom** **Bryan Passwater Notes** **Textbook Correlation: enVision A|G|A - Algebra 2** **AA.PAR.6.1** - Lessons 10-1, 10-2, Topic 10-Mathematical Modeling in 3 Acts **AA.PAR.6.2** - Lessons 1-7, 10-5, Topic 10-Mathematical Modeling in 3 Acts **AA.PAR.6.3** - Lessons 1-7, 10-4, 10-5 **AA.PAR.6.4** - Lesson 1-6, Topic 1-Mathematical Modeling in 3 Acts