Unit 3: Matrix Foundations and Algebraic Operations

Content Area: **Mathematics**
Course(s): **Algebra 3CP**
Time Period: **Semester 1**
Length: **5 weeks**
Status: **Published**

Unit Description

The unit develops students' understanding of matrices as powerful mathematical tools used to organize information, represent linear systems, and solve complex problems efficiently. Students explore matrix operations, including addition, subtraction, scalar multiplication, matrix multiplication, determinants, and the application of technology to perform computations. Building upon prior knowledge of linear systems, students learn how matrices provide an alternative method for solving systems of equations through matrix equations, inverse matrices, and Cramer's Rule. Emphasis is placed on conceptual understanding, mathematical reasoning, and the strategic use of technology to support problem-solving. Instruction is designed to support learners who may struggle with mathematics by incorporating visual models, structured procedures, and real-world applications that demonstrate the usefulness of matrices in various fields.

Standards

MA.N-VM.C	Perform operations on matrices and use matrices in applications.
MA.N-VM.C.8	Add, subtract, and multiply matrices of appropriate dimensions.
MA.N-VM.C.9	Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.
MA.N-VM.C.10	Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.
MA.A-REI.C.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
MA.A-REI.C.9	Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).
MA.A-REI.D.11	Explain why the □-coordinates of the points where the graphs of the equations □ = □(□) and □ = □(□) intersect are the solutions of the equation□(□) = □(□); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where □(□) and/or □(□) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Enduring Understanding

Students will understand that:

- Matrices provide an organized method for representing and analyzing numerical information.
- Matrix operations follow specific rules that determine when and how calculations can be performed.

- Different matrix operations produce different mathematical results and serve different purposes.
- Matrix multiplication is fundamentally different from addition and subtraction.
- Determinants provide important information about matrices and the solvability of systems.
- Linear systems can be represented and solved using matrix methods.
- Technology can increase efficiency and accuracy when working with matrices.
- Multiple methods can be used to solve the same problem, and some methods are more efficient depending on the situation.

Essential Questions

What is a matrix, and how can it be used to organize information?

How do matrix operations compare to operations with real numbers?

Why are matrix dimensions important when performing operations?

How does matrix multiplication differ from other matrix operations?

What information does a determinant provide?

How can matrices be used to solve systems of equations?

When is Cramer's Rule an effective strategy for solving a system?

How does technology support mathematical problem-solving involving matrices?

How can matrices be applied to real-world situations?

Knowledge and Skills

- Define matrices and identify rows, columns, and dimensions.
- Interpret matrices as representations of organized data and mathematical relationships.
- Understand conditions required for matrix operations.
- Explain the meaning and purpose of determinants.
- Recognize how matrices can represent linear systems.
- Understand the connection between matrix equations and systems of equations.
- Analyze the advantages and limitations of different matrix-solving methods.
- Explain the role of technology in matrix computations

Transfer Goals

Students will independently use matrices to organize, analyze, and solve problems involving multiple

variables and relationships. They will apply matrix concepts and technology tools to model real-world situations, solve systems efficiently, interpret quantitative information, and make informed decisions. Students will transfer their understanding of matrix operations and linear systems to future mathematical studies, career-related applications, and problem-solving situations that require structured analysis, precision, and strategic thinking.

Resources

Intermediate Algebra with Applications 5/6th ed by Aufmann/Barker/Lockwood

Online resources which include, but are not limited to: Desmos Graphing Calculator, Class Kick, Delta Math, Khan Academy, and CK-12 Foundation's Algebra 2 with Trigonometry Concepts by CK-12/Gloag/ Rawley, last modified April 12, 2024