Pre-Calculus Honors - Unit D - Systems of Equations

Unit Focus

This short unit reviews systems of equations, with a new perspective of the graphing calculator. The traditional methods of substitution and elimination are covered, but with more complicated systems than just linear equations. The graphing calculator is used to confirm exact answers found algebraically and also used to solve equations that would be very difficult to solve by hand (ex: natural logs). No solution and infinite solutions results are discussed in the context of the intersections of the graphs of the equations. Linear systems of three variables are at first solved by hand through repeated elimination and back substitution, but these methods are quickly replaced with matrices on the graphing calculator. A brief overview of matrices is given, but most of the focus is on solving multivariable linear systems. Finally, systems are used for a new concept, partial fraction decomposition.

Stage 1: Desired Results - Key Understandings

Standard(s)

Common Core
Mathematics: 9-12

- Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. (CCSS.MATH.CONTENT.HSN.VM.C.6)
- Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. (CCSS.MATH.CONTENT.HSN.VM.C.7)
- Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties. (CCSS.MATH.CONTENT.HSN.VM.C.9)
- Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. (CCSS.MATH.CONTENT.HSA.REI.C.5)
- Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (CCSS.MATH.CONTENT.HSA.REI.C.6)
- Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$. (CCSS.MATH.CONTENT.HSA.REI.C.7)
- Represent a system of linear equations as a single matrix equation in a vector variable. (CCSS.MATH.CONTENT.HSA.REI.C.8)
- 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 x 3 or greater). (CCSS.MATH.CONTENT.HSA.REI.C.9)

Transfer

Students will be able to independently use their learning to...
T1 manipulate equations/expressions or objects to create order and establish relationships.
T2 make sense of a problem, initiate a plan, execute it, and evaluate the reasonableness of the solution.
T3 use appropriate tools to make reaching solutions more efficient, accessible and accurate.

Meaning

Understanding(s)	Essential Question(s)
Students will understand that... **U1** Mathematicians flexibly use different tools, strategies, and operations to build conceptual knowledge or solve problems. **U2** Mathematicians apply the mathematics they know to solve problems occurring in everyday life.	*Students will keep considering...* **Q1** What is another way that this problem could be solved? **Q2** How do I decide if my answer makes sense and if not, what do I do? **Q3** What is the most efficient way to solve this problem?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
Students will know... **K1** There are many techniques available to solve a system of equations **K2** What it means to find the solution to a system of equations	*Students will be skilled at...* **S1** Solving systems of equations **S2** Creating systems of equation to solve real world problems

Stage 1: Desired Results - Key Understandings		
• Model with mathematics. (CCSS.MATH.MP.4) • Use appropriate tools strategically. (CCSS.MATH.MP.5) • Attend to precision. (CCSS.MATH.MP.6) **Madison Public Schools Profile of a Graduate** • Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)	**K3** The graphing calculator can be used to confirm answers, but not always find exact answers **K4** How to interpret infinite solutions and no solutions in systems of equations **K5** How to create a matrix to solve a linear system of equations **K6** Vocabulary: substitution, elimination, rowechelon form, matrix, order, augmented, reduced row-echelon form, partial fraction, decomposition	**S3** Using the graphing calculator to at least confirm solutions **S4** Decomposing a rational expression into partial fractions