Precalculus: Unit 5 Instructional Focus – Systems and Matrices

Topic	Instructional Foci
Topic 1: The Algebra of Matrices	Matrices can be used to model and manipulate data. Matrices of appropriate dimensions can be added, subtracted and multiplied, and can be multiplied by a scalar. Matrix multiplication is not commutative for square matrices, but the distributive and associative properties apply. There are additive and multiplicative identity matrices. Matrices can be used to perform transformations in the plane. ***Background:*** In C2.0 Geometry, students investigated transformations of points and geometric shapes and learned that translations could be described using vectors. In C2.0 Algebra 1 and Algebra 2, they studied transformations of functions. In Unit 4 of C2.0 Precalculus, students have explored the properties of vector operations. In this topic, students will learn that matrices of a particular size with the operations of addition and scalar multiplication have important properties that will later be seen as part of the definition of a vector space in Linear Algebra. In this sense, row or column matrices can be considered vectors, and matrices of all dimensions can also be thought of as being comprised of vertical and horizontal component vectors. Building on their prior learning, students will see how matrices can be used to transform vectors, and honors students will connect matrix transformations to their work with polar forms of complex numbers and vector-valued functions. ***Concepts:*** 1. Define terminology and notation related to matrices, and develop the operations of addition, subtraction, and scalar multiplication in a manner analogous to the operations on vectors. (Addison-Wesley §7.2, Glencoe §2.3) 2. Develop and apply matrix multiplication based on the dot product for vectors. (Addison-Wesley §7.2, Glencoe §2.3) 3. Develop the formula for the multiplicative inverse of a 2×2 matrix, and explain how the definition of the determinant of a 2×2 matrix simplifies the formula and helps to clarify when the multiplicative inverse exists. (Addison-Wesley §7.2, Glencoe §2.5) 4. Explain the properties of matrices over the operations of addition and multiplication, and use them to transform vectors in a plane. (Addison-Wesley §7.2, Glencoe §2.4) 5. Interpret the absolute value of the determinant in terms of area. (Glencoe §2.5)

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Topic 2: Applications of Matrices	Systems of equations can be written as a matrix/vector equation, which can be solved using multiplicative inverse of a matrix. ***Background:*** In C2.0 Algebra 1, students solved systems of linear equations using substitution, linear combination, and graphing. They also learned that equations of the form $f(x)=g(x)$ could be solved by finding the intersection of $y=f(x)$ and $y=g(x)$, where *f* and *g* were linear, exponential or quadratic functions. In C2.0 Geometry, students extended their learning to solving systems of two conics or a conic and a straight line, usually by graphing and verifying the points of intersection. In C2.0 Algebra 2, they encountered polynomial, rational, radical, and trigonometric equations that could be solved by finding intersections of functions, and they used the corresponding graphs to explain the occurrence of extraneous solutions. ***Concepts:*** 1. Solve a system of 3 linear equations and 3 unknowns by hand using substitution or linear combination. (Addison-Wesley §7.3, Glencoe §2.2) 2. Use the properties of vectors/matrices to write systems of equations as matrix equations and solve. (Addison-Wesley §7.3, Glencoe §2.3) 3. Fit a polynomial to any given number of points by writing a system of equations and solving. (Addison-Wesley §7.3) 4. Find the partial fraction decomposition of a rational expression whose denominator factors into 3 or more distinct linear factors. (Addison-Wesley §7.4, Glencoe §4.6)