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| **Common Core Standards** | **Common Core Standards** | **Mathematic Practices** |
| N = Number and Quantity Overview N-RN = The Real Number System N-Q = Quantities N-CN = The Complex Number System N-VM = Vector and Matrix QuantitiesA= Algebra Overview A-SSE = Seeing Structure in Expressions A-APR= Arithmetic with Polynomials and Rational Expressions A-CED= Creating Equations A-REI = Reasoning with Equations  and inequalitiesF= Functions Overview  F-IF = Interpreting Functions F-BF = Building Functions F-LE = Linear and Exponential ModelsF-TF = Trigonometric Functions | G = Geometry Overview G-CO = Congruence G-SRT = Similarity, Right Triangles and Trigonometry G-C = Circles G-GPE = Expressing Geometric Properties with Equations G-GMD = Geometric Measurement and Dimension G-MG = Modeling with GeometryS=Statistics and Probability S-ID = Categorical and Quantitative Data S-IC = Inferences and Justifying Conclusions S-CP = Conditional Probability and Rules of Probability S-MD = Using Probability to Make Decisions | 1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.
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| **Common Core Standards** | **Converted/Unpacked Standards** |  |
| CC.9-12.N.RN.1 Extend the properties of exponents to rational exponents. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define 5^(1/3) to be the cube root of 5 because we want [5^(1/3)]^3 = 5^[(1/3) x 3] to hold, so [5^(1/3)]^3 must equal 5. | N.RN.1 Understand that the denominator of the rational exponent is the root index and the numerator is the exponent of the radicand. For example, 51/2 =N.RN.1 Extend the properties of exponents to justify that (51/2 )2 = 5 |  |
| CC.9-12.N.RN.2 Extend the properties of exponents to rational exponents. Rewrite expressions involving radicals and rational exponents using the properties of exponents. | N.RN.2 Convert from radical representation to using rational exponents and vise versa. |  |
| CC.9-12.N.RN.3 Use properties of rational and irrational numbers. Explain why the sum or product of rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. | N.RN.3 Know and justify that when adding or multiplying two rational numbers the result is a rational number N.RN.3 Know and justify that when adding a rational number and an irrational number the result is irrational.N.RN.3 Know and justify that when multiplying of a nonzero rational number and an irrational number the result is irrational |  |
| CC.9-12.N.Q.1 Reason quantitatively and use units to solve problems. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.\* | N.Q.1 Interpret units in the context of the problem N.Q.1 When solving a multi-step problem, use units to evaluate the appropriateness of the solution. N.Q.1 Choose the appropriate units for a specific formula and interpret the meaning of the unit in that context. N.Q.1 Choose and interpret both the scale and the origin in graphs and data displays |  |
| CC.9-12.N.Q.2 Reason quantitatively and use units to solve problems. Define appropriate quantities for the purpose of descriptive modeling.\* | N.Q.2 Determine and interpret appropriate quantities when useing descriptive modeling. |  |
| CC.9-12.N.Q.3 Reason quantitatively and use units to solve problems. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.\* | N.Q.3 Determine the accuracy of values based on their limitations in the context of the situation. |  |
| CC.9-12.N.CN.1 Perform arithmetic operations with complex numbers. Know there is a complex number i such that i^2 = −1, and every complex number has the form a + bi with a and b real.  | N.CN.1 Know that every number is a complex number of the form a + bi, where a and b are real numbers. N.CN.1 Know that the complex number i2 = –1. |  |
| CC.9-12.N.CN.2 Perform arithmetic operations with complex numbers. Use the relation i2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. | N.CN.2 Apply the fact that the complex number i2 = –1.N.CN.2 Use the associative, commutative, and distributive properties, to add, subtract, and multiply complex numbers. |  |
| CC.9-12.N.CN.3 (+) Perform arithmetic operations with complex numbers. Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers. | N.CN.3 Given a complex number, find it’s conjugate and use it to find quotients of complex numbers.N.CN.3 Find the magnitude (length), modulus(length) or absolute value(length), of the vector representation of a complex number. |  |
| CC.9-12.N.CN.4 (+) Represent complex numbers and their operations on the complex plane. Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number. | N.CN.4 Transform complex numbers in a complex plane from rectangular to polar form and vise versa, N.CN.4 Know and explain why both forms, rectangular and polar, represent the same number. |  |
| CC.9-12.N.CN.5 (+) Represent complex numbers and their operations on the complex plane. Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. For example, (-1 + √3i)^3 = 8 because (-1 + √3i) has modulus 2 and argument 120°. | N.CN.5 Geometrically show addition, subtraction, and multiplication of complex numbers on the complex coordinate plane.N.CN.5 Geometrically show that the conjugate of complex numbers in a complex plane is the reflection across the x-axis.N.CN.5 Evaluate the power of a complex number, in rectangular form, using the polar form of that complex number. |  |
| CC.9-12.N.CN.6 (+) Represent complex numbers and their operations on the complex plane. Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints. | N.CN.6 Calculate the distance between values in the complex plane as the magnitude, modulus, of the difference, and the midpoint of a segment as the average of the coordinates of its endpoints. |  |
| CC.9-12.N.CN.7 Use complex numbers in polynomial identities and equations. Solve quadratic equations with real coefficients that have complex solutions. | N.CN.7 Solve quadratic equations with real coefficients that have solutions of the form a + bi and a – bi. |  |
| CC.9-12.N.CN.8 (+) Use complex numbers in polynomial identities and equations. Extend polynomial identities to the complex numbers. For example, rewrite x^2 + 4 as (x + 2i)(x – 2i). | N.CN.8 Use polynomial identities to write equivalent expressions in the form of complex numbers |  |
| CC.9-12.N.CN.9 (+) Use complex numbers in polynomial identities and equations. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials. | N.CN.9 Understand The Fundamental Theorem of Algebra, which says that the number of complex solutions to a polynomial equation is the same as the degree of the polynomial. Show that this is true for a quadratic polynomial. |  |
| CC.9-12.N.VM.1 (+) Represent and model with vector quantities. Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v(bold), |v|, ||v||, v(not bold)). | N.VM.1 Know that a vector is a directed line segment representing magnitude and direction. N.VM.1 Use the appropriate symbol representation for vectors and their magnitude. |  |
| CC.9-12.N.VM.2 (+) Represent and model with vector quantities. Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. | N.VM.2 Find the component form of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point, therefore placing the initial point of the vector at the origin. |  |
| CC.9-12.N.VM.3 (+) Represent and model with vector quantities. Solve problems involving velocity and other quantities that can be represented by vectors. | N.VM.3 Solve problems such as velocity and other quantities that can be represented using vectors. |  |
| CC.9-12.N.VM.4 (+) Perform operations on vectors. Add and subtract vectors. |  |  |
| CC.9-12.N.VM.4a (+) Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. | N.VM.4a Know how to add vectors head to tail, using the horizontal and vertical components, and by finding the diagonal formed by the parallelogram. |  |
| CC.9-12.N.VM.4b (+) Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.  | N.VM.4b Understand that the magnitude of a sum of two vectors is not the sum of the magnitudes unless the vectors have the same heading or direction. |  |
| CC.9-12.N.VM.4c (+) Understand vector subtraction v – w as v + (–w), where (–w) is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise. | N.VM.4c Know how to subtract vectors and that vector subtraction is defined much like subtraction of real numbers, in that v – w is the same as v + (–w), where –w is the additive inverse of w. The opposite of w, -w, has the same magnitude, but the direction of the angle differs by 180 .N.VM.4c Represent vector subtraction on a graph by connecting the vectors head to tail in the correct order and using the components of those vectors to find the difference. |  |
| CC.9-12.N.VM.5 (+) Perform operations on vectors. Multiply a vector by a scalar. |  |  |
| CC.9-12.N.VM.5a (+) Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as c(v(sub x), v(sub y)) = (cv(sub x), cv(sub y)). | N.VM.5a Represent scalar multiplication of vectors on a graph by increasing or decreasing the magnitude of the vector by the factor of the given scalar. If the scalar is less than zero, the new vector’s direction is opposite the original vector’s direction.N.VM.5a Represent scalar multiplication of vectors using the component form, such as c(vx, vy) = (cvx, cvy). |  |
| CC.9-12.N.VM.5b (+) Compute the magnitude of a scalar multiple cv using ||cv|| = |c|v. Compute the direction of cv knowing that when |c|v ≠ 0, the direction of cv is either along v (for c > 0) or against v (for c < 0). | N.VM.5b Find the magnitude of a scalar multiple, cv, is the magnitude of v multiplied by the factor of the |c|. Know when c > 0, the direction is the same, and when c < 0, then the direction of the vector is opposite the direction of the original vector. |  |
| CC.9-12.N.VM.6 (+) Perform operations on matrices and use matrices in applications. Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.  | N.VM.6 Represent and manipulate data using matrices, e.g., to organize merchandise, keep total sales, costs, and using graph theory and adjacency matrices to make predictions. |  |
| CC.9-12.N.VM.7 (+) Perform operations on matrices and use matrices in applications. Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.  | N.VM.7 Multiply matrices by a scalar, e.g., when the inventory of jeans for July is twice that for January. |  |
| CC.9-12.N.VM.8 (+) Perform operations on matrices and use matrices in applications. Add, subtract, and multiply matrices of appropriate dimensions. | N.VM.8 Know that the dimensions of a matrix are based on the number of rows and columns. N.VM.8 Add, subtract, and multiply matrices of appropriate dimensions. |  |
| CC.9-12.N.VM.9 (+) Perform operations on matrices and use matrices in applications. Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.  | N.VM.9 Understand that matrix multiplication is not commutative, AB BA, however it is associative and satisfies the distributive properties. |  |
| CC.9-12.N.VM.10 (+) Perform operations on matrices and use matrices in applications. 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.  | N.VM.10 Identify a zero matrix and understand that it behaves in matrix addition, subtraction, and multiplication, much like 0 in the real numbers system.N.VM.10 Identify an identity matrix for a square matrix and understand that it behaves in matrix multiplication 21436 much like the number 1 in the real number system.539 814N.VM.10 Find the determinant of a square matrix, and know that it is a nonzero value if the matrix has an inverse. 11111N.VM.10 Know that if a matrix has an inverse, then the determinant of a square matrix is a nonzero value. |  |
| CC.9-12.N.VM.11 (+) Perform operations on matrices and use matrices in applications. Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors. | N.VM.11 To translate the vector , where A(1,3) and B(4,9), 2 units to the right and 5 units up, perform the following matrix multiplication. |  |
| CC.9-12.N.VM.12 (+) Perform operations on matrices and use matrices in applications. Work with 2 X 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.  | N.VM.12 Given the coordinates of the vertices of a parallelogram in the coordinate plane, find the vector representation for two adjacent sides with the same initial point. Write the components of the vectors in a 2x2 matrix and find the determinant of the 2x2 matrix. The absolute value of the determinant is the area of the parallelogram. (This is called the dot product of the two vectors.) |  |