Common Core Skill Alignment

HIGH SCHOOL: HIGH SCHOOL

9-12.HSN Number and Quantity

9-12.HSN-RN The Real Number System

9-12.HSN-RN.A Extend the properties of exponents to rational exponents.

9-12.HSN-RN.A.1 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.

- [ ] Evaluate integers raised to rational exponents (Algebra 1 - V.10)
- [ ] Evaluate rational exponents (Algebra 2 - M.1)
- [ ] Evaluate rational exponents (Precalculus - H.4)

9-12.HSN-RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

- [ ] Simplify radical expressions (Algebra 1 - EE.1)
- [ ] Simplify radical expressions with variables (Algebra 1 - EE.2)
- [ ] Simplify radical expressions involving fractions (Algebra 1 - EE.3)
- [ ] Multiply radical expressions (Algebra 1 - EE.4)
- [ ] Add and subtract radical expressions (Algebra 1 - EE.5)
- [ ] Simplify radical expressions using the distributive property (Algebra 1 - EE.6)
- [ ] Simplify radical expressions: mixed review (Algebra 1 - EE.8)
- [ ] Simplify radical expressions (Geometry - A.4)
- [ ] Simplify radical expressions with variables I (Algebra 2 - L.4)
- [ ] Simplify radical expressions with variables II (Algebra 2 - L.5)
- [ ] Nth roots (Algebra 2 - L.6)
- [ ] Multiply radical expressions (Algebra 2 - L.7)
- [ ] Divide radical expressions (Algebra 2 - L.8)
- [ ] Add and subtract radical expressions (Algebra 2 - L.9)

- [ ] Simplify radical expressions using the distributive property (Algebra 2 - L.10)
- [ ] Simplify radical expressions using conjugates (Algebra 2 - L.11)
- [ ] Multiplication with rational exponents (Algebra 2 - M.2)
- [ ] Division with rational exponents (Algebra 2 - M.3)
- [ ] Power rule (Algebra 2 - M.4)
- [ ] Simplify expressions involving rational exponents I (Algebra 2 - M.5)
- [ ] Simplify expressions involving rational exponents II (Algebra 2 - M.6)
- [ ] Operations with rational exponents (Precalculus - H.5)
- [ ] Simplify radical expressions with variables (Precalculus - H.6)
- [ ] Nth roots (Precalculus - H.7)
- [ ] Simplify expressions involving rational exponents (Precalculus - H.8)

9-12.HSN-RN.B Use properties of rational and irrational numbers.

9-12.HSN-RN.B.3 Explain why the sum or product of two 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.

- [ ] Sort rational and irrational numbers (Algebra 1 - A.8)
- [ ] Classify rational and irrational numbers (Algebra 1 - A.9)
- [ ] Sort rational and irrational numbers (Precalculus - Q.1)
- [ ] Classify rational and irrational numbers (Precalculus - Q.2)
- [ ] Properties of operations on rational and irrational numbers (Precalculus - Q.3)

9-12.HSN-Q Quantities

9-12.HSN-Q.A Reason quantitatively and use units to solve problems.

9-12.HSN-Q.A.1 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.

- [ ] Scale drawings: word problems (Algebra 1 - C.7)
- [ ] Convert rates and measurements: customary units (Algebra 1 - E.1)
- [ ] Convert rates and measurements: metric units (Algebra 1 - E.2)

- [ ] Unit prices with unit conversions (Algebra 1 - E.3)
- [ ] Scale drawings: word problems (Geometry - A.2)
- [ ] Convert rates and measurements: customary units (Geometry - W.1)
- [ ] Convert rates and measurements: metric units (Geometry - W.2)
- [ ] Convert square and cubic units of length (Geometry - W.3)

9-12.HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

- [ ] Scale drawings: word problems (Algebra 1 - C.7)
- [ ] Solve linear equations: word problems (Algebra 1 - J.10)
- [ ] Solve a system of equations using any method: word problems (Algebra 1 - U.15)
- [ ] Exponential growth and decay: word problems (Algebra 1 - X.5)
- [ ] Scale drawings: word problems (Geometry - A.2)
- [ ] Solve linear equations: word problems (Algebra 2 - B.2)
- [ ] Solve a system of equations using any method: word problems (Algebra 2 - E.11)
- [ ] Exponential growth and decay: word problems (Algebra 2 - S.12)
- [ ] Compound interest: word problems (Algebra 2 - S.13)
- [ ] Exponential growth and decay: word problems (Precalculus - F.16)
- [ ] Compound interest: word problems (Precalculus - F.17)

9-12.HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

- [ ] Precision (Algebra 1 - E.4)
- [ ] Greatest possible error (Algebra 1 - E.5)
- [ ] Minimum and maximum area and volume (Algebra 1 - E.6)
- [ ] Percent error (Algebra 1 - E.7)
- [ ] Percent error: area and volume (Algebra 1 - E.8)
- [ ] Precision (Geometry - W.4)
- [ ] Greatest possible error (Geometry - W.5)
- [ ] Minimum and maximum area and volume (Geometry - W.6)

☐ Percent error (Geometry - W.7)

☐ Percent error: area and volume (Geometry - W.8)

9-12.HSN-CN The Complex Number System

9-12.HSN-CN.A Perform arithmetic operations with complex numbers.

9-12.HSN-CN.A.1 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.

☐ Introduction to complex numbers (Algebra 2 - H.1)

9-12.HSN-CN.A.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

☐ Add and subtract complex numbers (Algebra 2 - H.2)

☐ Multiply complex numbers (Algebra 2 - H.4)

☐ Powers of i (Algebra 2 - H.8)

☐ Add and subtract complex numbers (Precalculus - R.1)

☐ Powers of i (Precalculus - R.6)

9-12.HSN-CN.A.3 Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

☐ Complex conjugates (Algebra 2 - H.3)

☐ Divide complex numbers (Algebra 2 - H.5)

☐ Add, subtract, multiply, and divide complex numbers (Algebra 2 - H.6)

☐ Absolute values of complex numbers (Algebra 2 - H.7)

☐ Complex conjugates (Precalculus - R.2)

☐ Multiply and divide complex numbers (Precalculus - R.3)

☐ Add, subtract, multiply, and divide complex numbers (Precalculus - R.4)

☐ Absolute values of complex numbers (Precalculus - R.5)

9-12.HSN-CN.B Represent complex numbers and their operations on the complex plane.

9-12.HSN-CN.B.4 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.

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☐ Introduction to the complex plane (Precalculus - S.1)

☐ Graph complex numbers (Precalculus - S.2)

☐ Absolute value in the complex plane (Precalculus - S.6)

☐ Find the modulus and argument of a complex number (Precalculus - T.1)

☐ Convert complex numbers from rectangular to polar form (Precalculus - T.2)

☐ Convert complex numbers from polar to rectangular form (Precalculus - T.3)

☐ Convert complex numbers between rectangular and polar form (Precalculus - T.4)

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9-12.HSN-CN.B.5 Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation.

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☐ Addition in the complex plane (Precalculus - S.3)

☐ Subtraction in the complex plane (Precalculus - S.4)

☐ Graph complex conjugates (Precalculus - S.5)

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9-12.HSN-CN.B.6 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.

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☐ Midpoints in the complex plane (Precalculus - S.7)

☐ Distance in the complex plane (Precalculus - S.8)

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9-12.HSN-CN.C Use complex numbers in polynomial identities and equations.

9-12.HSN-CN.C.7 Solve quadratic equations with real coefficients that have complex solutions.

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☐ Using the discriminant (Algebra 2 - J.10)

☐ Solve a quadratic equation using square roots (Precalculus - C.5)

☐ Using the discriminant (Precalculus - C.9)

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9-12.HSN-CN.C.8 Extend polynomial identities to the complex numbers.

- [ ] Solve polynomial equations (Algebra 2 - K.7)
- [ ] Complex conjugate theorem (Algebra 2 - K.11)
- [ ] Conjugate root theorems (Algebra 2 - K.12)
- [ ] Complex conjugate theorem (Precalculus - D.7)
- [ ] Conjugate root theorems (Precalculus - D.8)

9-12.HSN-CN.C.9 Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

- [ ] Fundamental Theorem of Algebra (Algebra 2 - K.15)
- [ ] Fundamental Theorem of Algebra (Precalculus - D.10)

9-12.HSN-VM Vector and Matrix Quantities

9-12.HSN-VM.A Represent and model with vector quantities.

9-12.HSN-VM.A.1 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, $|v|$, $||v||$, v).

- [ ] Compass directions and vectors (Geometry - Y.1)
- [ ] Find the magnitude of a vector (Geometry - Y.2)
- [ ] Find the magnitude of a vector (Precalculus - U.1)
- [ ] Find the direction angle of a vector (Precalculus - U.3)
- [ ] Find the magnitude of a three-dimensional vector (Precalculus - V.1)

9-12.HSN-VM.A.2 Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

- [ ] Find the component form of a vector (Geometry - Y.3)
- [ ] Find the component form of a vector (Precalculus - U.2)
- [ ] Find the component form of a three-dimensional vector (Precalculus - V.2)

9-12.HSN-VM.A.3 Solve problems involving velocity and other quantities that can be represented by vectors.

9-12.HSN-VM.B Perform operations on vectors.

9-12.HSN-VM.B.4 Add and subtract vectors.

9-12.HSN-VM.B.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.

    ☐ Graph a resultant vector using the triangle method (Geometry - Y.5)

    ☐ Graph a resultant vector using the parallelogram method (Geometry - Y.6)

    ☐ Add and subtract vectors (Geometry - Y.7)

    ☐ Graph a resultant vector using the triangle method (Precalculus - U.5)

    ☐ Graph a resultant vector using the parallelogram method (Precalculus - U.6)

    ☐ Add and subtract vectors (Precalculus - U.7)

    ☐ Add and subtract three-dimensional vectors (Precalculus - V.3)

9-12.HSN-VM.B.4b Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.

    ☐ Find the magnitude and direction of a vector sum (Precalculus - U.8)

9-12.HSN-VM.B.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.

    ☐ Add and subtract vectors (Geometry - Y.7)

    ☐ Add and subtract vectors (Precalculus - U.7)

    ☐ Add and subtract three-dimensional vectors (Precalculus - V.3)

9-12.HSN-VM.B.5 Multiply a vector by a scalar.

9-12.HSN-VM.B.5a Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.

    ☐ Multiply a vector by a scalar (Precalculus - U.9)

    ☐ Scalar multiples of three-dimensional vectors (Precalculus - V.4)

9-12.HSN-VM.B.5b Compute the magnitude of a scalar multiple cv using ||cv|| = |c|·||v||. Compute the direction of cv knowing that when |c|v is not equal to 0, the direction of cv is either along v (for c > 0) or against v (for c < 0).

Find the magnitude of a vector scalar multiple (Precalculus - U.10)

Determine the direction of a vector scalar multiple (Precalculus - U.11)

9-12.HSN-VM.C Perform operations on matrices and use matrices in applications.

9-12.HSN-VM.C.6 Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.

9-12.HSN-VM.C.7 Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.

Multiply a matrix by a scalar (Algebra 1 - M.4)

Multiply a matrix by a scalar (Algebra 2 - G.4)

Multiply a matrix by a scalar (Precalculus - L.4)

9-12.HSN-VM.C.8 Add, subtract, and multiply matrices of appropriate dimensions.

Matrix operation rules (Algebra 1 - M.2)

Add and subtract matrices (Algebra 1 - M.3)

Add and subtract scalar multiples of matrices (Algebra 1 - M.5)

Multiply two matrices (Algebra 1 - M.6)

Matrix operation rules (Algebra 2 - G.2)

Add and subtract matrices (Algebra 2 - G.3)

Add and subtract scalar multiples of matrices (Algebra 2 - G.5)

Multiply two matrices (Algebra 2 - G.6)

Simplify matrix expressions (Algebra 2 - G.7)

Add and subtract matrices (Precalculus - L.3)

Add and subtract scalar multiples of matrices (Precalculus - L.5)

Multiply two matrices (Precalculus - L.6)

Simplify matrix expressions (Precalculus - L.7)

9-12.HSN-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.

☐ Properties of matrices (Algebra 2 - G.8)

☐ Matrix operation rules (Precalculus - L.2)

☐ Properties of matrices (Precalculus - L.8)

9-12.HSN-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.

☐ Determinant of a matrix (Algebra 2 - G.10)

☐ Is a matrix invertible? (Algebra 2 - G.11)

☐ Inverse of a matrix (Algebra 2 - G.12)

☐ Identify inverse matrices (Algebra 2 - G.13)

☐ Determinant of a matrix (Precalculus - L.10)

☐ Is a matrix invertible? (Precalculus - L.11)

☐ Inverse of a 2 x 2 matrix (Precalculus - L.12)

☐ Inverse of a 3 x 3 matrix (Precalculus - L.13)

☐ Identify inverse matrices (Precalculus - L.14)

9-12.HSN-VM.C.11 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.

☐ Identify transformation matrices (Algebra 2 - G.15)

☐ Transformation matrices: write the vertex matrix (Algebra 2 - G.16)

☐ Transformation matrices: graph the image (Algebra 2 - G.17)

☐ Identify transformation matrices (Precalculus - L.16)

☐ Transformation matrices: write the vertex matrix (Precalculus - L.17)

☐ Transformation matrices: graph the image (Precalculus - L.18)

9-12.HSN-VM.C.12 Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.

- [ ] Identify transformation matrices (Algebra 2 - G.15)

- [ ] Transformation matrices: write the vertex matrix (Algebra 2 - G.16)

- [ ] Transformation matrices: graph the image (Algebra 2 - G.17)

9-12.HSA Algebra

9-12.HSA-SSE Seeing Structure in Expressions

9-12.HSA-SSE.A Interpret the structure of expressions

9-12.HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.

9-12.HSA-SSE.A.1a Interpret parts of an expression, such as terms, factors, and coefficients.

- [ ] Polynomial vocabulary (Algebra 1 - Z.1)

- [ ] Polynomial vocabulary (Algebra 2 - K.1)

9-12.HSA-SSE.A.1b Interpret complicated expressions by viewing one or more of their parts as a single entity.

- [ ] Factor using a quadratic pattern (Algebra 2 - I.4)

- [ ] Factor using a quadratic pattern (Precalculus - D.14)

9-12.HSA-SSE.A.2 Use the structure of an expression to identify ways to rewrite it.

- [ ] Simplify variable expressions using properties (Algebra 1 - H.3)

- [ ] Simplify variable expressions involving like terms and the distributive property (Algebra 1 - I.2)

- [ ] Evaluate expressions using properties of exponents (Algebra 1 - V.8)

- [ ] Powers of monomials (Algebra 1 - Y.5)

- [ ] Factor out a monomial (Algebra 1 - AA.2)

- [ ] Simplify radical expressions (Algebra 1 - EE.1)

- [ ] Simplify radical expressions with variables (Algebra 1 - EE.2)

- [ ] Simplify radical expressions involving fractions (Algebra 1 - EE.3)

- [ ] Simplify radical expressions: mixed review (Algebra 1 - EE.8)

- [ ] Simplify rational expressions (Algebra 1 - GG.3)

- [ ] Simplify radical expressions (Geometry - A.4)

- [ ] Simplify variable expressions using properties (Algebra 2 - A.3)

- [ ] Factor using a quadratic pattern (Algebra 2 - I.4)

- [ ] Pascal's triangle and the Binomial Theorem (Algebra 2 - K.17)

- [ ] Binomial Theorem I (Algebra 2 - K.18)

- [ ] Binomial Theorem II (Algebra 2 - K.19)

- [ ] Simplify radical expressions with variables I (Algebra 2 - L.4)

- [ ] Simplify radical expressions with variables II (Algebra 2 - L.5)

- [ ] Simplify radical expressions using conjugates (Algebra 2 - L.11)

- [ ] Simplify expressions involving rational exponents I (Algebra 2 - M.5)

- [ ] Simplify expressions involving rational exponents II (Algebra 2 - M.6)

- [ ] Simplify rational expressions (Algebra 2 - N.4)

- [ ] Factor using a quadratic pattern (Precalculus - D.14)

- [ ] Pascal's triangle and the Binomial Theorem (Precalculus - D.17)

- [ ] Binomial Theorem I (Precalculus - D.18)

- [ ] Binomial Theorem II (Precalculus - D.19)

- [ ] Simplify radical expressions with variables (Precalculus - H.6)

- [ ] Simplify expressions involving rational exponents (Precalculus - H.8)

9-12.HSA-SSE.B Write expressions in equivalent forms to solve problems

9-12.HSA-SSE.B.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

9-12.HSA-SSE.B.3a Factor a quadratic expression to reveal the zeros of the function it defines.

- [ ] Factor quadratics with leading coefficient 1 (Algebra 1 - AA.4)

- [ ] Factor quadratics with other leading coefficients (Algebra 1 - AA.5)

- [ ] Factor quadratics: special cases (Algebra 1 - AA.6)

- [ ] Solve a quadratic equation by factoring (Algebra 1 - BB.7)

- [ ] Solve a quadratic equation by factoring (Geometry - A.9)

Factor quadratics (Algebra 2 - I.3)

Solve a quadratic equation by factoring (Algebra 2 - J.6)

Solve a quadratic equation by factoring (Precalculus - C.6)

9-12.HSA-SSE.B.3b Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

Complete the square (Algebra 1 - BB.8)

Complete the square (Algebra 2 - J.7)

Find the maximum or minimum value of a quadratic function (Precalculus - C.1)

9-12.HSA-SSE.B.3c Use the properties of exponents to transform expressions for exponential functions.

Evaluate expressions using properties of exponents (Algebra 1 - V.8)

Evaluate an exponential function (Algebra 1 - X.1)

Properties of exponents (Geometry - A.3)

Evaluate rational exponents (Algebra 2 - M.1)

Simplify expressions involving rational exponents I (Algebra 2 - M.5)

Simplify expressions involving rational exponents II (Algebra 2 - M.6)

Evaluate exponential functions (Algebra 2 - S.2)

9-12.HSA-SSE.B.4 Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.

Find the sum of a finite arithmetic or geometric series (Algebra 2 - BB.12)

Find the sum of a finite arithmetic or geometric series (Precalculus - W.11)

9-12.HSA-APR Arithmetic with Polynomials and Rational Expressions

9-12.HSA-APR.A Perform arithmetic operations on polynomials

9-12.HSA-APR.A.1 Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

- [ ] Model polynomials with algebra tiles (Algebra 1 - Z.2)
- [ ] Add and subtract polynomials using algebra tiles (Algebra 1 - Z.3)
- [ ] Add and subtract polynomials (Algebra 1 - Z.4)
- [ ] Add polynomials to find perimeter (Algebra 1 - Z.5)
- [ ] Multiply a polynomial by a monomial (Algebra 1 - Z.6)
- [ ] Multiply two polynomials using algebra tiles (Algebra 1 - Z.7)
- [ ] Multiply two binomials (Algebra 1 - Z.8)
- [ ] Multiply two binomials: special cases (Algebra 1 - Z.9)
- [ ] Multiply polynomials (Algebra 1 - Z.10)
- [ ] Add and subtract polynomials (Algebra 2 - K.2)
- [ ] Multiply polynomials (Algebra 2 - K.3)

9-12.HSA-APR.B Understand the relationship between zeros and factors of polynomials

9-12.HSA-APR.B.2 Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x — a is p(a), so p(a) = 0 if and only if (x — a) is a factor of p(x).

- [ ] Write a quadratic function from its zeros (Algebra 2 - J.12)
- [ ] Evaluate polynomials using synthetic division (Algebra 2 - K.6)
- [ ] Find the roots of factored polynomials (Algebra 2 - K.8)
- [ ] Write a polynomial from its roots (Algebra 2 - K.9)
- [ ] Evaluate polynomials using synthetic division (Precalculus - D.3)
- [ ] Find the roots of factored polynomials (Precalculus - D.4)
- [ ] Write a polynomial from its roots (Precalculus - D.5)

9-12.HSA-APR.B.3 Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

- [ ] Solve a quadratic equation using the zero product property (Algebra 1 - BB.6)
- [ ] Match quadratic functions and graphs (Algebra 1 - BB.12)
- [ ] Solve a quadratic equation using the zero product property (Algebra 2 - J.5)
- [ ] Match quadratic functions and graphs (Algebra 2 - J.11)
- [ ] Find the roots of factored polynomials (Algebra 2 - K.8)

- [ ] Match polynomials and graphs (Algebra 2 - K.14)
- [ ] Match quadratic functions and graphs (Precalculus - C.4)
- [ ] Find the roots of factored polynomials (Precalculus - D.4)
- [ ] Match polynomials and graphs (Precalculus - D.11)

9-12.HSA-APR.C Use polynomial identities to solve problems

9-12.HSA-APR.C.4 Prove polynomial identities and use them to describe numerical relationships.

- [ ] Multiply two binomials (Algebra 1 - Z.8)
- [ ] Multiply two binomials: special cases (Algebra 1 - Z.9)
- [ ] Multiply polynomials (Algebra 1 - Z.10)
- [ ] Factor sums and differences of cubes (Algebra 2 - I.6)
- [ ] Add and subtract polynomials (Algebra 2 - K.2)
- [ ] Multiply polynomials (Algebra 2 - K.3)
- [ ] Factor sums and differences of cubes (Precalculus - D.12)
- [ ] Solve equations with sums and differences of cubes (Precalculus - D.13)

9-12.HSA-APR.C.5 Know and apply the Binomial Theorem for the expansion of (x + y) to the n power in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

- [ ] Multiply two binomials: special cases (Algebra 1 - Z.9)
- [ ] Pascal's triangle (Algebra 2 - K.16)
- [ ] Pascal's triangle and the Binomial Theorem (Algebra 2 - K.17)
- [ ] Binomial Theorem I (Algebra 2 - K.18)
- [ ] Binomial Theorem II (Algebra 2 - K.19)
- [ ] Pascal's triangle (Precalculus - D.16)
- [ ] Pascal's triangle and the Binomial Theorem (Precalculus - D.17)
- [ ] Binomial Theorem I (Precalculus - D.18)
- [ ] Binomial Theorem II (Precalculus - D.19)

9-12.HSA-APR.D Rewrite rational expressions

9-12.HSA-APR.D.6 Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.

- [ ] Simplify rational expressions (Algebra 1 - GG.3)
- [ ] Divide polynomials (Algebra 1 - GG.5)
- [ ] Divide polynomials using long division (Algebra 2 - K.4)
- [ ] Simplify rational expressions (Algebra 2 - N.4)
- [ ] Divide polynomials using long division (Precalculus - D.1)

9-12.HSA-APR.D.7 Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

- [ ] Multiply and divide rational expressions (Algebra 1 - GG.4)
- [ ] Add and subtract rational expressions (Algebra 1 - GG.6)
- [ ] Multiply and divide rational expressions (Algebra 2 - N.5)
- [ ] Add and subtract rational expressions (Algebra 2 - N.6)

9-12.HSA-CED Creating Equations

9-12.HSA-CED.A Create equations that describe numbers or relationships

9-12.HSA-CED.A.1 Create equations and inequalities in one variable and use them to solve problems.

- [ ] Write variable equations (Algebra 1 - I.4)
- [ ] Model and solve equations using algebra tiles (Algebra 1 - J.1)
- [ ] Write and solve equations that represent diagrams (Algebra 1 - J.2)
- [ ] Solve linear equations: word problems (Algebra 1 - J.10)
- [ ] Write inequalities from graphs (Algebra 1 - K.2)
- [ ] Write compound inequalities from graphs (Algebra 1 - K.13)
- [ ] Consecutive integer problems (Algebra 1 - O.3)
- [ ] Weighted averages: word problems (Algebra 1 - O.5)
- [ ] Write variable expressions (Geometry - A.5)

- [ ] Solve linear equations: word problems (Algebra 2 - B.2)
- [ ] Write inequalities from graphs (Algebra 2 - C.2)

9-12.HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

- [ ] Write direct variation equations (Algebra 1 - R.4)
- [ ] Write inverse variation equations (Algebra 1 - R.7)
- [ ] Write and solve inverse variation equations (Algebra 1 - R.8)
- [ ] Slope-intercept form: graph an equation (Algebra 1 - S.6)
- [ ] Slope-intercept form: write an equation from a graph (Algebra 1 - S.7)
- [ ] Slope-intercept form: write an equation (Algebra 1 - S.8)
- [ ] Slope-intercept form: write an equation from a table (Algebra 1 - S.9)
- [ ] Slope-intercept form: write an equation from a word problem (Algebra 1 - S.10)
- [ ] Write linear functions to solve word problems (Algebra 1 - S.12)
- [ ] Write equations in standard form (Algebra 1 - S.15)
- [ ] Standard form: graph an equation (Algebra 1 - S.17)
- [ ] Point-slope form: graph an equation (Algebra 1 - S.20)
- [ ] Point-slope form: write an equation (Algebra 1 - S.21)
- [ ] Graph quadratic functions in vertex form (Algebra 1 - BB.4)
- [ ] Write linear, quadratic, and exponential functions (Algebra 1 - CC.3)
- [ ] Graph an absolute value function (Algebra 1 - DD.2)
- [ ] Graph a linear equation (Geometry - E.3)
- [ ] Equations of lines (Geometry - E.4)
- [ ] Graph a linear function (Algebra 2 - D.7)
- [ ] Write the equation of a linear function (Algebra 2 - D.8)
- [ ] Graph a quadratic function (Algebra 2 - J.3)
- [ ] Write and solve direct variation equations (Algebra 2 - Q.1)
- [ ] Write and solve inverse variation equations (Algebra 2 - Q.2)
- [ ] Write joint and combined variation equations I (Algebra 2 - Q.4)
- [ ] Write joint and combined variation equations II (Algebra 2 - Q.6)

- [ ] Solve variation equations (Algebra 2 - Q.7)

- [ ] Write equations of parabolas in vertex form using properties (Algebra 2 - T.6)

- [ ] Graph parabolas (Algebra 2 - T.9)

- [ ] Write equations of circles in standard form using properties (Algebra 2 - U.4)

- [ ] Graph circles (Algebra 2 - U.7)

- [ ] Write equations of sine functions using properties (Algebra 2 - Z.3)

- [ ] Graph sine functions (Algebra 2 - Z.4)

- [ ] Write equations of cosine functions using properties (Algebra 2 - Z.7)

- [ ] Graph cosine functions (Algebra 2 - Z.8)

- [ ] Graph sine and cosine functions (Algebra 2 - Z.9)

- [ ] Graph a quadratic function (Precalculus - C.3)

- [ ] Write equations of sine functions using properties (Precalculus - N.3)

- [ ] Graph sine functions (Precalculus - N.4)

- [ ] Write equations of cosine functions using properties (Precalculus - N.7)

- [ ] Graph cosine functions (Precalculus - N.8)

- [ ] Graph sine and cosine functions (Precalculus - N.9)

- [ ] Write equations of parabolas in vertex form (Precalculus - P.2)

- [ ] Graph parabolas (Precalculus - P.3)

- [ ] Write equations of circles in standard form (Precalculus - P.5)

- [ ] Graph circles (Precalculus - P.6)

9-12.HSA-CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.

- [ ] Linear inequalities: word problems (Algebra 1 - T.4)

- [ ] Solve a system of equations by graphing: word problems (Algebra 1 - U.3)

- [ ] Solve a system of equations using substitution: word problems (Algebra 1 - U.9)

- [ ] Solve a system of equations using elimination: word problems (Algebra 1 - U.11)

- [ ] Solve a system of equations using augmented matrices: word problems (Algebra 1 - U.13)

- [ ] Solve a system of equations using any method: word problems (Algebra 1 - U.15)

- [ ] Write a linear inequality: word problems (Algebra 2 - C.3)

- [ ] Solve a system of equations by graphing: word problems (Algebra 2 - E.3)
- [ ] Solve a system of equations using substitution: word problems (Algebra 2 - E.7)
- [ ] Solve a system of equations using elimination: word problems (Algebra 2 - E.9)
- [ ] Solve a system of equations using any method: word problems (Algebra 2 - E.11)
- [ ] Solve a system of equations by graphing: word problems (Precalculus - I.2)
- [ ] Solve a system of equations using substitution: word problems (Precalculus - I.5)
- [ ] Solve a system of equations using elimination: word problems (Precalculus - I.7)

9-12.HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

- [ ] Rearrange multi-variable equations (Algebra 1 - I.8)
- [ ] Rate of travel: word problems (Algebra 1 - O.4)
- [ ] Solve multi-variable equations (Algebra 2 - B.6)

9-12.HSA-REI Reasoning with Equations and Inequalities

9-12.HSA-REI.A Understand solving equations as a process of reasoning and explain the reasoning

9-12.HSA-REI.A.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

- [ ] Properties of equality (Algebra 1 - H.4)
- [ ] Solve equations: complete the solution (Algebra 1 - J.7)
- [ ] Solve equations: complete the solution (Algebra 2 - B.3)

9-12.HSA-REI.A.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

- [ ] Solve radical equations I (Algebra 1 - FF.4)
- [ ] Solve radical equations II (Algebra 1 - FF.5)
- [ ] Solve rational equations (Algebra 1 - GG.7)
- [ ] Solve radical equations (Algebra 2 - L.13)

- [ ] Solve rational equations (Algebra 2 - N.7)

- [ ] Solve rational equations (Precalculus - E.2)

- [ ] Solve radical equations (Precalculus - G.2)

9-12.HSA-REI.B Solve equations and inequalities in one variable

9-12.HSA-REI.B.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

- [ ] Rearrange multi-variable equations (Algebra 1 - I.8)

- [ ] Model and solve equations using algebra tiles (Algebra 1 - J.1)

- [ ] Write and solve equations that represent diagrams (Algebra 1 - J.2)

- [ ] Solve one-step linear equations (Algebra 1 - J.3)

- [ ] Solve two-step linear equations (Algebra 1 - J.4)

- [ ] Solve advanced linear equations (Algebra 1 - J.5)

- [ ] Solve equations with variables on both sides (Algebra 1 - J.6)

- [ ] Solve equations: complete the solution (Algebra 1 - J.7)

- [ ] Solve linear equations: word problems (Algebra 1 - J.10)

- [ ] Solve linear equations: mixed review (Algebra 1 - J.11)

- [ ] Identify solutions to inequalities (Algebra 1 - K.3)

- [ ] Solve one-step linear inequalities: addition and subtraction (Algebra 1 - K.4)

- [ ] Solve one-step linear inequalities: multiplication and division (Algebra 1 - K.5)

- [ ] Solve one-step linear inequalities (Algebra 1 - K.6)

- [ ] Solve two-step linear inequalities (Algebra 1 - K.8)

- [ ] Solve advanced linear inequalities (Algebra 1 - K.10)

- [ ] Solve compound inequalities (Algebra 1 - K.14)

- [ ] Solve linear equations (Geometry - A.6)

- [ ] Solve linear inequalities (Geometry - A.7)

- [ ] Solve linear equations (Algebra 2 - B.1)

- [ ] Solve linear equations: word problems (Algebra 2 - B.2)

- [ ] Solve linear inequalities (Algebra 2 - C.4)

9-12.HSA-REI.B.4 Solve quadratic equations in one variable.

9-12.HSA-REI.B.4a Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

☐ Complete the square (Algebra 1 - BB.8)

☐ Complete the square (Algebra 2 - J.7)

9-12.HSA-REI.B.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

☐ Solve a quadratic equation using square roots (Algebra 1 - BB.5)

☐ Solve a quadratic equation using the zero product property (Algebra 1 - BB.6)

☐ Solve a quadratic equation by factoring (Algebra 1 - BB.7)

☐ Complete the square (Algebra 1 - BB.8)

☐ Solve a quadratic equation by completing the square (Algebra 1 - BB.9)

☐ Solve a quadratic equation using the quadratic formula (Algebra 1 - BB.10)

☐ Solve a quadratic equation by factoring (Geometry - A.9)

☐ Solve a quadratic equation using the quadratic formula (Geometry - A.10)

☐ Solve a quadratic equation using square roots (Algebra 2 - J.4)

☐ Solve a quadratic equation using the zero product property (Algebra 2 - J.5)

☐ Solve a quadratic equation by factoring (Algebra 2 - J.6)

☐ Complete the square (Algebra 2 - J.7)

☐ Solve a quadratic equation using the quadratic formula (Algebra 2 - J.9)

☐ Solve a quadratic equation using square roots (Precalculus - C.5)

☐ Solve a quadratic equation by factoring (Precalculus - C.6)

☐ Solve a quadratic equation by completing the square (Precalculus - C.7)

☐ Solve a quadratic equation using the quadratic formula (Precalculus - C.8)

9-12.HSA-REI.C Solve systems of equations

9-12.HSA-REI.C.5 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.

- [ ] Solve a system of equations using elimination (Algebra 1 - U.10)
- [ ] Solve a system of equations using elimination: word problems (Algebra 1 - U.11)
- [ ] Solve a system of equations using elimination (Algebra 2 - E.8)
- [ ] Solve a system of equations using elimination: word problems (Algebra 2 - E.9)
- [ ] Solve a system of equations using elimination (Precalculus - I.6)
- [ ] Solve a system of equations using elimination: word problems (Precalculus - I.7)

9-12.HSA-REI.C.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

- [ ] Is (x, y) a solution to the system of equations? (Algebra 1 - U.1)
- [ ] Solve a system of equations by graphing (Algebra 1 - U.2)
- [ ] Solve a system of equations by graphing: word problems (Algebra 1 - U.3)
- [ ] Find the number of solutions to a system of equations by graphing (Algebra 1 - U.4)
- [ ] Find the number of solutions to a system of equations (Algebra 1 - U.5)
- [ ] Classify a system of equations by graphing (Algebra 1 - U.6)
- [ ] Solve a system of equations using substitution (Algebra 1 - U.8)
- [ ] Solve a system of equations using substitution: word problems (Algebra 1 - U.9)
- [ ] Solve a system of equations using elimination (Algebra 1 - U.10)
- [ ] Solve a system of equations using elimination: word problems (Algebra 1 - U.11)
- [ ] Solve a system of equations using augmented matrices (Algebra 1 - U.12)
- [ ] Solve a system of equations using augmented matrices: word problems (Algebra 1 - U.13)
- [ ] Solve a system of equations using any method (Algebra 1 - U.14)
- [ ] Solve a system of equations using any method: word problems (Algebra 1 - U.15)
- [ ] Solve systems of linear equations (Geometry - A.8)
- [ ] Is (x, y) a solution to the system of equations? (Algebra 2 - E.1)
- [ ] Solve a system of equations by graphing (Algebra 2 - E.2)
- [ ] Solve a system of equations by graphing: word problems (Algebra 2 - E.3)
- [ ] Find the number of solutions to a system of equations (Algebra 2 - E.4)
- [ ] Solve a system of equations using substitution (Algebra 2 - E.6)
- [ ] Solve a system of equations using substitution: word problems (Algebra 2 - E.7)

- [ ] Solve a system of equations using elimination (Algebra 2 - E.8)
- [ ] Solve a system of equations using elimination: word problems (Algebra 2 - E.9)
- [ ] Solve a system of equations using any method (Algebra 2 - E.10)
- [ ] Solve a system of equations using any method: word problems (Algebra 2 - E.11)
- [ ] Solve a system of equations by graphing (Precalculus - I.1)
- [ ] Solve a system of equations by graphing: word problems (Precalculus - I.2)
- [ ] Classify a system of equations (Precalculus - I.3)
- [ ] Solve a system of equations using substitution (Precalculus - I.4)
- [ ] Solve a system of equations using substitution: word problems (Precalculus - I.5)
- [ ] Solve a system of equations using elimination (Precalculus - I.6)
- [ ] Solve a system of equations using elimination: word problems (Precalculus - I.7)

9-12.HSA-REI.C.7 Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

- [ ] Systems of linear and quadratic equations (Algebra 1 - BB.13)
- [ ] Solve a system of linear and quadratic equations (Algebra 2 - E.15)

9-12.HSA-REI.C.8 Represent a system of linear equations as a single matrix equation in a vector variable.

- [ ] Solve a system of equations using augmented matrices (Algebra 1 - U.12)
- [ ] Solve a system of equations using augmented matrices: word problems (Algebra 1 - U.13)
- [ ] Solve a system of equations using augmented matrices (Algebra 2 - G.18)
- [ ] Solve a system of equations using augmented matrices: word problems (Algebra 2 - G.19)

9-12.HSA-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).

- [ ] Inverse of a matrix (Algebra 2 - G.12)
- [ ] Solve matrix equations using inverses (Algebra 2 - G.14)
- [ ] Inverse of a 2 x 2 matrix (Precalculus - L.12)
- [ ] Inverse of a 3 x 3 matrix (Precalculus - L.13)

□ Solve matrix equations using inverses (Precalculus - L.15)

9-12.HSA-REI.D Represent and solve equations and inequalities graphically

9-12.HSA-REI.D.10 Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

□ Relations: convert between tables, graphs, mappings, and lists of points (Algebra 1 - Q.1)

□ Find values using function graphs (Algebra 1 - Q.6)

□ Complete a function table from an equation (Algebra 1 - Q.10)

□ Interpret the graph of a function: word problems (Algebra 1 - Q.11)

□ Complete a table and graph a linear function (Algebra 1 - S.13)

□ Find values using function graphs (Algebra 2 - D.4)

□ Complete a table for a function graph (Algebra 2 - D.5)

9-12.HSA-REI.D.11 Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

□ Solve a system of equations by graphing (Algebra 1 - U.2)

□ Solve a system of equations by graphing: word problems (Algebra 1 - U.3)

□ Find the number of solutions to a system of equations by graphing (Algebra 1 - U.4)

□ Solve a system of equations by graphing (Algebra 2 - E.2)

□ Solve a system of equations by graphing: word problems (Algebra 2 - E.3)

□ Find the number of solutions to a system of equations (Algebra 2 - E.4)

□ Solve a system of equations by graphing (Precalculus - I.1)

□ Solve a system of equations by graphing: word problems (Precalculus - I.2)

9-12.HSA-REI.D.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

□ Graph a two-variable linear inequality (Algebra 1 - T.3)

- [ ] Solve systems of linear inequalities by graphing (Algebra 1 - T.6)
- [ ] Graph a two-variable linear inequality (Algebra 2 - C.8)
- [ ] Solve systems of linear inequalities by graphing (Algebra 2 - F.2)
- [ ] Solve systems of linear inequalities by graphing (Precalculus - J.1)

9-12.HSF Functions

9-12.HSF-IF Interpreting Functions

9-12.HSF-IF.A Understand the concept of a function and use function notation

9-12.HSF-IF.A.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

- [ ] Domain and range of relations (Algebra 1 - Q.2)
- [ ] Identify independent and dependent variables (Algebra 1 - Q.3)
- [ ] Identify functions (Algebra 1 - Q.4)
- [ ] Identify functions: vertical line test (Algebra 1 - Q.5)
- [ ] Find values using function graphs (Algebra 1 - Q.6)
- [ ] Complete a function table from a graph (Algebra 1 - Q.9)
- [ ] Complete a function table from an equation (Algebra 1 - Q.10)
- [ ] Domain and range of exponential functions: equations (Algebra 1 - X.4)
- [ ] Domain and range of absolute value functions: equations (Algebra 1 - DD.4)
- [ ] Domain and range of radical functions: equations (Algebra 1 - FF.3)
- [ ] Domain and range (Algebra 2 - D.1)
- [ ] Identify functions (Algebra 2 - D.2)
- [ ] Find values using function graphs (Algebra 2 - D.4)
- [ ] Complete a table for a function graph (Algebra 2 - D.5)
- [ ] Domain and range of radical functions (Algebra 2 - L.12)
- [ ] Domain and range of exponential and logarithmic functions (Algebra 2 - S.1)

- [ ] Domain and range (Precalculus - A.1)
- [ ] Identify functions (Precalculus - A.2)
- [ ] Find values using function graphs (Precalculus - A.4)
- [ ] Complete a table for a function graph (Precalculus - A.5)
- [ ] Domain and range of exponential and logarithmic functions (Precalculus - F.1)
- [ ] Domain and range of radical functions (Precalculus - G.1)

9-12.HSF-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

- [ ] Find values using function graphs (Algebra 1 - Q.6)
- [ ] Evaluate a function (Algebra 1 - Q.7)
- [ ] Evaluate a function: plug in an expression (Algebra 1 - Q.8)
- [ ] Complete a function table from an equation (Algebra 1 - Q.10)
- [ ] Evaluate an exponential function (Algebra 1 - X.1)
- [ ] Complete a function table: quadratic functions (Algebra 1 - BB.2)
- [ ] Complete a function table: absolute value functions (Algebra 1 - DD.1)
- [ ] Evaluate a radical function (Algebra 1 - FF.1)
- [ ] Evaluate functions (Algebra 2 - D.3)
- [ ] Find values using function graphs (Algebra 2 - D.4)
- [ ] Complete a table for a function graph (Algebra 2 - D.5)
- [ ] Complete a function table: quadratic functions (Algebra 2 - J.2)
- [ ] Evaluate exponential functions (Algebra 2 - S.2)
- [ ] Evaluate functions (Precalculus - A.3)
- [ ] Find values using function graphs (Precalculus - A.4)
- [ ] Complete a table for a function graph (Precalculus - A.5)

9-12.HSF-IF.A.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

- [ ] Identify arithmetic and geometric sequences (Algebra 1 - P.1)
- [ ] Arithmetic sequences (Algebra 1 - P.2)

- [ ] Geometric sequences (Algebra 1 - P.3)

- [ ] Evaluate variable expressions for number sequences (Algebra 1 - P.4)

- [ ] Write variable expressions for arithmetic sequences (Algebra 1 - P.5)

- [ ] Write variable expressions for geometric sequences (Algebra 1 - P.6)

- [ ] Number sequences: mixed review (Algebra 1 - P.7)

- [ ] Find terms of an arithmetic sequence (Algebra 2 - BB.1)

- [ ] Find terms of a geometric sequence (Algebra 2 - BB.2)

- [ ] Evaluate explicit formulas for sequences (Algebra 2 - BB.3)

- [ ] Evaluate recursive formulas for sequences (Algebra 2 - BB.4)

- [ ] Classify formulas and sequences (Algebra 2 - BB.5)

- [ ] Write a formula for an arithmetic sequence (Algebra 2 - BB.6)

- [ ] Write a formula for a geometric sequence (Algebra 2 - BB.7)

- [ ] Write a formula for a recursive sequence (Algebra 2 - BB.8)

- [ ] Sequences: mixed review (Algebra 2 - BB.9)

- [ ] Find terms of a sequence (Precalculus - W.1)

- [ ] Find terms of a recursive sequence (Precalculus - W.2)

- [ ] Identify a sequence as explicit or recursive (Precalculus - W.3)

- [ ] Find a recursive formula (Precalculus - W.4)

- [ ] Find recursive and explicit formulas (Precalculus - W.5)

9-12.HSF-IF.B Interpret functions that arise in applications in terms of the context

9-12.HSF-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

- [ ] Identify proportional relationships (Algebra 1 - R.1)

- [ ] Find the constant of variation (Algebra 1 - R.2)

- [ ] Graph a proportional relationship (Algebra 1 - R.3)

- [ ] Identify direct variation and inverse variation (Algebra 1 - R.6)

- [ ] Find the slope of a graph (Algebra 1 - S.2)

- [ ] Slope-intercept form: find the slope and y-intercept (Algebra 1 - S.5)

- [ ] Slope-intercept form: graph an equation (Algebra 1 - S.6)

- [ ] Complete a table and graph a linear function (Algebra 1 - S.13)

- [ ] Standard form: find x- and y-intercepts (Algebra 1 - S.16)

- [ ] Standard form: graph an equation (Algebra 1 - S.17)

- [ ] Point-slope form: graph an equation (Algebra 1 - S.20)

- [ ] Slopes of parallel and perpendicular lines (Algebra 1 - S.23)

- [ ] Match exponential functions and graphs (Algebra 1 - X.2)

- [ ] Characteristics of quadratic functions (Algebra 1 - BB.1)

- [ ] Graph quadratic functions in vertex form (Algebra 1 - BB.4)

- [ ] Identify linear, quadratic, and exponential functions from graphs (Algebra 1 - CC.1)

- [ ] Identify linear, quadratic, and exponential functions from tables (Algebra 1 - CC.2)

- [ ] Graph an absolute value function (Algebra 1 - DD.2)

- [ ] Rational functions: asymptotes and excluded values (Algebra 1 - GG.1)

- [ ] Slopes of lines (Geometry - E.2)

- [ ] Graph a linear equation (Geometry - E.3)

- [ ] Slopes of parallel and perpendicular lines (Geometry - E.5)

- [ ] Find the slope of a linear function (Algebra 2 - D.6)

- [ ] Graph a linear function (Algebra 2 - D.7)

- [ ] Characteristics of quadratic functions (Algebra 2 - J.1)

- [ ] Graph a quadratic function (Algebra 2 - J.3)

- [ ] Match quadratic functions and graphs (Algebra 2 - J.11)

- [ ] Match polynomials and graphs (Algebra 2 - K.14)

- [ ] Rational functions: asymptotes and excluded values (Algebra 2 - N.1)

- [ ] Classify variation (Algebra 2 - Q.3)

- [ ] Find the constant of variation (Algebra 2 - Q.5)

- [ ] Match exponential functions and graphs (Algebra 2 - S.3)

- [ ] Find the slope of a linear function (Precalculus - A.6)

- [ ] Graph a linear function (Precalculus - A.7)

- [ ] Find the maximum or minimum value of a quadratic function (Precalculus - C.1)

- [ ] Characteristics of quadratic functions (Precalculus - C.2)

- [ ] Graph a quadratic function (Precalculus - C.3)

- [ ] Match quadratic functions and graphs (Precalculus - C.4)

- [ ] Match polynomials and graphs (Precalculus - D.11)

- [ ] Rational functions: asymptotes and excluded values (Precalculus - E.1)

9-12.HSF-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

- [ ] Domain and range of exponential functions: graphs (Algebra 1 - X.3)

- [ ] Domain and range of absolute value functions: graphs (Algebra 1 - DD.3)

- [ ] Domain and range of absolute value functions: equations (Algebra 1 - DD.4)

- [ ] Domain and range of radical functions: graphs (Algebra 1 - FF.2)

- [ ] Domain and range of radical functions: equations (Algebra 1 - FF.3)

- [ ] Domain and range (Algebra 2 - D.1)

- [ ] Domain and range of radical functions (Algebra 2 - L.12)

- [ ] Domain and range of exponential and logarithmic functions (Algebra 2 - S.1)

- [ ] Domain and range (Precalculus - A.1)

- [ ] Domain and range of exponential and logarithmic functions (Precalculus - F.1)

- [ ] Domain and range of radical functions (Precalculus - G.1)

9-12.HSF-IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

- [ ] Find the constant of variation (Algebra 1 - R.2)

- [ ] Find the slope of a graph (Algebra 1 - S.2)

- [ ] Find the slope from two points (Algebra 1 - S.3)

- [ ] Slope-intercept form: find the slope and y-intercept (Algebra 1 - S.5)

- [ ] Slopes of lines (Geometry - E.2)

- [ ] Find the slope of a linear function (Algebra 2 - D.6)

- [ ] Average rate of change (Algebra 2 - D.10)

- [ ] Find the slope of a linear function (Precalculus - A.6)

- [ ] Average rate of change (Precalculus - A.10)

9-12.HSF-IF.C Analyze functions using different representations

9-12.HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

9-12.HSF-IF.C.7a Graph linear and quadratic functions and show intercepts, maxima, and minima.

- [ ] Slope-intercept form: graph an equation (Algebra 1 - S.6)
- [ ] Standard form: graph an equation (Algebra 1 - S.17)
- [ ] Point-slope form: graph an equation (Algebra 1 - S.20)
- [ ] Characteristics of quadratic functions (Algebra 1 - BB.1)
- [ ] Graph quadratic functions in vertex form (Algebra 1 - BB.4)
- [ ] Graph a linear equation (Geometry - E.3)
- [ ] Graph a linear function (Algebra 2 - D.7)
- [ ] Characteristics of quadratic functions (Algebra 2 - J.1)
- [ ] Graph a quadratic function (Algebra 2 - J.3)
- [ ] Graph a linear function (Precalculus - A.7)
- [ ] Find the maximum or minimum value of a quadratic function (Precalculus - C.1)
- [ ] Characteristics of quadratic functions (Precalculus - C.2)
- [ ] Graph a quadratic function (Precalculus - C.3)

9-12.HSF-IF.C.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

- [ ] Graph an absolute value function (Algebra 1 - DD.2)

9-12.HSF-IF.C.7c Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

- [ ] Graph quadratic functions in vertex form (Algebra 1 - BB.4)
- [ ] Graph a quadratic function (Algebra 2 - J.3)
- [ ] Match polynomials and graphs (Algebra 2 - K.14)
- [ ] Graph parabolas (Algebra 2 - T.9)
- [ ] Graph a quadratic function (Precalculus - C.3)

☐ Match polynomials and graphs (Precalculus - D.11)

9-12.HSF-IF.C.7d Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

☐ Rational functions: asymptotes and excluded values (Algebra 1 - GG.1)

☐ Rational functions: asymptotes and excluded values (Algebra 2 - N.1)

☐ Rational functions: asymptotes and excluded values (Precalculus - E.1)

9-12.HSF-IF.C.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

☐ Match exponential functions and graphs (Algebra 1 - X.2)

☐ Match exponential functions and graphs (Algebra 2 - S.3)

☐ Find properties of sine functions (Algebra 2 - Z.1)

☐ Graph sine functions (Algebra 2 - Z.4)

☐ Find properties of cosine functions (Algebra 2 - Z.5)

☐ Graph cosine functions (Algebra 2 - Z.8)

☐ Graph sine and cosine functions (Algebra 2 - Z.9)

☐ Find properties of sine functions (Precalculus - N.1)

☐ Graph sine functions (Precalculus - N.4)

☐ Find properties of cosine functions (Precalculus - N.5)

☐ Graph cosine functions (Precalculus - N.8)

☐ Graph sine and cosine functions (Precalculus - N.9)

9-12.HSF-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

9-12.HSF-IF.C.8a Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

☐ Characteristics of quadratic functions (Algebra 1 - BB.1)

☐ Solve a quadratic equation by factoring (Algebra 1 - BB.7)

☐ Solve a quadratic equation by completing the square (Algebra 1 - BB.9)

- [ ] Solve a quadratic equation by factoring (Geometry - A.9)
- [ ] Characteristics of quadratic functions (Algebra 2 - J.1)
- [ ] Solve a quadratic equation by factoring (Algebra 2 - J.6)
- [ ] Solve a quadratic equation by completing the square (Algebra 2 - J.8)
- [ ] Convert equations of parabolas from general to vertex form (Algebra 2 - T.7)
- [ ] Find properties of a parabola from equations in general form (Algebra 2 - T.8)
- [ ] Find the maximum or minimum value of a quadratic function (Precalculus - C.1)
- [ ] Characteristics of quadratic functions (Precalculus - C.2)
- [ ] Solve a quadratic equation by factoring (Precalculus - C.6)
- [ ] Solve a quadratic equation by completing the square (Precalculus - C.7)

9-12.HSF-IF.C.8b Use the properties of exponents to interpret expressions for exponential functions.

- [ ] Evaluate an exponential function (Algebra 1 - X.1)
- [ ] Match exponential functions and graphs (Algebra 1 - X.2)
- [ ] Domain and range of exponential and logarithmic functions (Algebra 2 - S.1)
- [ ] Evaluate exponential functions (Algebra 2 - S.2)
- [ ] Match exponential functions and graphs (Algebra 2 - S.3)
- [ ] Solve exponential equations using factoring (Algebra 2 - S.4)
- [ ] Domain and range of exponential and logarithmic functions (Precalculus - F.1)
- [ ] Solve exponential equations using factoring (Precalculus - F.3)

9-12.HSF-IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

- [ ] Compare linear functions: graphs, tables, and equations (Algebra 1 - S.14)

9-12.HSF-BF Building Functions

9-12.HSF-BF.A Build a function that models a relationship between two quantities

9-12.HSF-BF.A.1 Write a function that describes a relationship between two quantities.

9-12.HSF-BF.A.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.

- [ ] Write variable expressions for arithmetic sequences (Algebra 1 - P.5)
- [ ] Write variable expressions for geometric sequences (Algebra 1 - P.6)
- [ ] Write linear, quadratic, and exponential functions (Algebra 1 - CC.3)
- [ ] Write a formula for an arithmetic sequence (Algebra 2 - BB.6)
- [ ] Write a formula for a geometric sequence (Algebra 2 - BB.7)
- [ ] Write a formula for a recursive sequence (Algebra 2 - BB.8)
- [ ] Find a recursive formula (Precalculus - W.4)

9-12.HSF-BF.A.1b Combine standard function types using arithmetic operations.

- [ ] Add and subtract polynomials (Algebra 1 - Z.4)
- [ ] Multiply polynomials (Algebra 1 - Z.10)
- [ ] Multiply and divide rational expressions (Algebra 1 - GG.4)
- [ ] Add and subtract rational expressions (Algebra 1 - GG.6)
- [ ] Add and subtract polynomials (Algebra 2 - K.2)
- [ ] Multiply polynomials (Algebra 2 - K.3)
- [ ] Multiply and divide rational expressions (Algebra 2 - N.5)
- [ ] Add and subtract rational expressions (Algebra 2 - N.6)
- [ ] Add and subtract functions (Algebra 2 - O.1)
- [ ] Multiply functions (Algebra 2 - O.2)
- [ ] Divide functions (Algebra 2 - O.3)
- [ ] Add, subtract, multiply, and divide functions (Precalculus - A.11)

9-12.HSF-BF.A.1c Compose functions.

- [ ] Evaluate a function: plug in an expression (Algebra 1 - Q.8)
- [ ] Composition of linear functions: find a value (Algebra 2 - O.4)
- [ ] Composition of linear functions: find an equation (Algebra 2 - O.5)

☐ Composition of linear and quadratic functions: find a value (Algebra 2 - O.6)

☐ Composition of linear and quadratic functions: find an equation (Algebra 2 - O.7)

☐ Composition of functions (Precalculus - A.12)

9-12.HSF-BF.A.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

☐ Write variable expressions for arithmetic sequences (Algebra 1 - P.5)

☐ Write variable expressions for geometric sequences (Algebra 1 - P.6)

☐ Write a formula for an arithmetic sequence (Algebra 2 - BB.6)

☐ Write a formula for a geometric sequence (Algebra 2 - BB.7)

☐ Write a formula for a recursive sequence (Algebra 2 - BB.8)

☐ Find a recursive formula (Precalculus - W.4)

☐ Find recursive and explicit formulas (Precalculus - W.5)

☐ Convert a recursive formula to an explicit formula (Precalculus - W.6)

☐ Convert an explicit formula to a recursive formula (Precalculus - W.7)

☐ Convert between explicit and recursive formulas (Precalculus - W.8)

9-12.HSF-BF.B Build new functions from existing functions

9-12.HSF-BF.B.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.

☐ Transformations of linear functions (Algebra 1 - S.25)

☐ Transformations of quadratic functions (Algebra 1 - BB.3)

☐ Transformations of absolute value functions (Algebra 1 - DD.5)

☐ Function transformation rules (Algebra 2 - P.1)

☐ Translations of functions (Algebra 2 - P.2)

☐ Reflections of functions (Algebra 2 - P.3)

☐ Dilations of functions (Algebra 2 - P.4)

☐ Transformations of functions (Algebra 2 - P.5)

☐ Describe function transformations (Algebra 2 - P.6)

- [ ] Function transformation rules (Precalculus - B.1)
- [ ] Translations of functions (Precalculus - B.2)
- [ ] Reflections of functions (Precalculus - B.3)
- [ ] Dilations of functions (Precalculus - B.4)
- [ ] Transformations of functions (Precalculus - B.5)
- [ ] Describe function transformations (Precalculus - B.6)

9-12.HSF-BF.B.4 Find inverse functions.

9-12.HSF-BF.B.4a Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse.

- [ ] Find inverse functions and relations (Algebra 2 - O.11)
- [ ] Solve exponential equations using common logarithms (Algebra 2 - S.5)
- [ ] Solve exponential equations using natural logarithms (Algebra 2 - S.6)
- [ ] Solve logarithmic equations I (Algebra 2 - S.7)
- [ ] Solve logarithmic equations II (Algebra 2 - S.8)
- [ ] Solve logarithmic equations with one logarithm (Precalculus - F.11)

9-12.HSF-BF.B.4b Verify by composition that one function is the inverse of another.

- [ ] Identify inverse functions (Algebra 2 - O.8)
- [ ] Identify inverse functions (Precalculus - A.13)
- [ ] Check whether two rational functions are inverses (Precalculus - E.3)

9-12.HSF-BF.B.4c Read values of an inverse function from a graph or a table, given that the function has an inverse.

- [ ] Find values of inverse functions from tables (Algebra 2 - O.9)
- [ ] Find values of inverse functions from graphs (Algebra 2 - O.10)
- [ ] Find values of inverse functions from tables (Precalculus - A.14)
- [ ] Find values of inverse functions from graphs (Precalculus - A.15)

9-12.HSF-BF.B.4d Produce an invertible function from a non-invertible function by restricting the domain.

9-12.HSF-BF.B.5 Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

- [ ] Convert between exponential and logarithmic form: rational bases (Algebra 2 - R.1)
- [ ] Solve exponential equations using common logarithms (Algebra 2 - S.5)
- [ ] Solve exponential equations using natural logarithms (Algebra 2 - S.6)
- [ ] Solve logarithmic equations I (Algebra 2 - S.7)
- [ ] Solve logarithmic equations II (Algebra 2 - S.8)
- [ ] Convert between exponential and logarithmic form (Precalculus - F.2)
- [ ] Solve exponential equations using logarithms (Precalculus - F.10)
- [ ] Solve logarithmic equations with one logarithm (Precalculus - F.11)
- [ ] Solve logarithmic equations with multiple logarithms (Precalculus - F.12)

9-12.HSF-LE Linear, Quadratic, and Exponential Models

9-12.HSF-LE.A Construct and compare linear, quadratic, and exponential models and solve problems

9-12.HSF-LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

9-12.HSF-LE.A.1a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

- [ ] Describe linear and exponential growth and decay (Algebra 1 - CC.6)
- [ ] Identify linear and exponential functions (Algebra 2 - S.10)
- [ ] Describe linear and exponential growth and decay (Algebra 2 - S.11)
- [ ] Identify linear and exponential functions (Precalculus - F.14)
- [ ] Describe linear and exponential growth and decay (Precalculus - F.15)

9-12.HSF-LE.A.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

☐ Solve linear equations: word problems (Algebra 1 - J.10)

☐ Rate of travel: word problems (Algebra 1 - O.4)

☐ Identify linear, quadratic, and exponential functions from graphs (Algebra 1 - CC.1)

☐ Identify linear, quadratic, and exponential functions from tables (Algebra 1 - CC.2)

☐ Linear functions over unit intervals (Algebra 1 - CC.4)

☐ Solve linear equations: word problems (Algebra 2 - B.2)

☐ Linear functions over unit intervals (Algebra 2 - D.9)

☐ Average rate of change (Algebra 2 - D.10)

☐ Linear functions over unit intervals (Precalculus - A.9)

9-12.HSF-LE.A.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

☐ Exponential growth and decay: word problems (Algebra 1 - X.5)

☐ Identify linear, quadratic, and exponential functions from graphs (Algebra 1 - CC.1)

☐ Identify linear, quadratic, and exponential functions from tables (Algebra 1 - CC.2)

☐ Exponential functions over unit intervals (Algebra 1 - CC.5)

☐ Exponential functions over unit intervals (Algebra 2 - S.9)

☐ Exponential growth and decay: word problems (Algebra 2 - S.12)

☐ Exponential functions over unit intervals (Precalculus - F.13)

☐ Exponential growth and decay: word problems (Precalculus - F.16)

9-12.HSF-LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

☐ Write variable expressions for arithmetic sequences (Algebra 1 - P.5)

☐ Write variable expressions for geometric sequences (Algebra 1 - P.6)

☐ Slope-intercept form: write an equation from a graph (Algebra 1 - S.7)

☐ Slope-intercept form: write an equation (Algebra 1 - S.8)

☐ Slope-intercept form: write an equation from a table (Algebra 1 - S.9)

☐ Slope-intercept form: write an equation from a word problem (Algebra 1 - S.10)

- [ ] Write linear functions to solve word problems (Algebra 1 - S.12)
- [ ] Point-slope form: write an equation (Algebra 1 - S.21)
- [ ] Point-slope form: write an equation from a graph (Algebra 1 - S.22)
- [ ] Write an equation for a parallel or perpendicular line (Algebra 1 - S.24)
- [ ] Write linear, quadratic, and exponential functions (Algebra 1 - CC.3)
- [ ] Equations of lines (Geometry - E.4)
- [ ] Equations of parallel and perpendicular lines (Geometry - E.6)
- [ ] Write the equation of a linear function (Algebra 2 - D.8)
- [ ] Write a formula for an arithmetic sequence (Algebra 2 - BB.6)
- [ ] Write a formula for a geometric sequence (Algebra 2 - BB.7)
- [ ] Write the equation of a linear function (Precalculus - A.8)

9-12.HSF-LE.A.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

9-12.HSF-LE.A.4 For exponential models, express as a logarithm the solution to ab to the ct power $= d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

- [ ] Solve exponential equations using common logarithms (Algebra 2 - S.5)
- [ ] Solve exponential equations using natural logarithms (Algebra 2 - S.6)
- [ ] Convert between exponential and logarithmic form (Precalculus - F.2)
- [ ] Evaluate logarithms (Precalculus - F.4)
- [ ] Solve exponential equations using logarithms (Precalculus - F.10)

9-12.HSF-LE.B Interpret expressions for functions in terms of the situation they model

9-12.HSF-LE.B.5 Interpret the parameters in a linear or exponential function in terms of a context.

- [ ] Solve linear equations: word problems (Algebra 1 - J.10)
- [ ] Exponential growth and decay: word problems (Algebra 1 - X.5)
- [ ] Solve linear equations: word problems (Algebra 2 - B.2)
- [ ] Exponential growth and decay: word problems (Algebra 2 - S.12)
- [ ] Compound interest: word problems (Algebra 2 - S.13)

<div>□ Continuously compounded interest: word problems (Algebra 2 - S.14)</div>

<div>□ Exponential growth and decay: word problems (Precalculus - F.16)</div>

<div>□ Compound interest: word problems (Precalculus - F.17)</div>

9-12.HSF-TF Trigonometric Functions

9-12.HSF-TF.A Extend the domain of trigonometric functions using the unit circle

9-12.HSF-TF.A.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

□ Convert between radians and degrees (Algebra 2 - X.1)

□ Radians and arc length (Algebra 2 - X.2)

□ Convert between radians and degrees (Precalculus - M.1)

□ Radians and arc length (Precalculus - M.2)

9-12.HSF-TF.A.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

□ Coterminal angles (Algebra 2 - X.5)

□ Reference angles (Algebra 2 - X.6)

□ Find trigonometric ratios using the unit circle (Algebra 2 - Y.6)

□ Coterminal and reference angles (Precalculus - M.4)

□ Find trigonometric ratios using the unit circle (Precalculus - M.6)

□ Find trigonometric ratios using reference angles (Precalculus - M.7)

9-12.HSF-TF.A.3 Use special triangles to determine geometrically the values of sine, cosine, tangent for pi/3, pi/4 and pi/6, and use the unit circle to express the values of sine, cosine, and tangent for pi-x, pi+x, and 2pi-x in terms of their values for x, where x is any real number.

□ Find trigonometric functions of special angles (Geometry - R.5)

□ Sin, cos, and tan of special angles (Algebra 2 - Y.7)

□ Find trigonometric ratios using right triangles (Precalculus - M.5)

9-12.HSF-TF.A.4 Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

- [ ] Symmetry and periodicity of trigonometric functions (Algebra 2 - AA.2)
- [ ] Symmetry and periodicity of trigonometric functions (Precalculus - O.2)

9-12.HSF-TF.B Model periodic phenomena with trigonometric functions

9-12.HSF-TF.B.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

- [ ] Find properties of sine functions (Algebra 2 - Z.1)
- [ ] Write equations of sine functions from graphs (Algebra 2 - Z.2)
- [ ] Write equations of sine functions using properties (Algebra 2 - Z.3)
- [ ] Find properties of cosine functions (Algebra 2 - Z.5)
- [ ] Write equations of cosine functions from graphs (Algebra 2 - Z.6)
- [ ] Write equations of cosine functions using properties (Algebra 2 - Z.7)
- [ ] Find properties of sine functions (Precalculus - N.1)
- [ ] Write equations of sine functions from graphs (Precalculus - N.2)
- [ ] Write equations of sine functions using properties (Precalculus - N.3)
- [ ] Find properties of cosine functions (Precalculus - N.5)
- [ ] Write equations of cosine functions from graphs (Precalculus - N.6)
- [ ] Write equations of cosine functions using properties (Precalculus - N.7)

9-12.HSF-TF.B.6 Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

- [ ] Inverses of trigonometric functions (Algebra 1 - HH.3)
- [ ] Inverses of trigonometric functions (Geometry - R.7)
- [ ] Inverses of sin, cos, and tan (Algebra 2 - Y.10)
- [ ] Inverses of trigonometric functions (Precalculus - M.8)

9-12.HSF-TF.B.7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

☐ Solve trigonometric equations I (Algebra 2 - Y.12)

☐ Solve trigonometric equations II (Algebra 2 - Y.13)

☐ Solve trigonometric equations (Precalculus - M.9)

9-12.HSF-TF.C Prove and apply trigonometric identities

9-12.HSF-TF.C.8 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ and the quadrant of the angle.

☐ Prove the Pythagorean theorem (Geometry - P.15)

☐ Trigonometric identities I (Algebra 2 - AA.3)

☐ Trigonometric identities II (Algebra 2 - AA.4)

☐ Trigonometric identities I (Precalculus - O.3)

☐ Trigonometric identities II (Precalculus - O.4)

9-12.HSF-TF.C.9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

9-12.HSG Geometry

9-12.HSG-CO Congruence

9-12.HSG-CO.A Experiment with transformations in the plane

9-12.HSG-CO.A.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.

☐ Angle vocabulary (Geometry - C.1)

9-12.HSG-CO.A.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

☐ Classify congruence transformations (Geometry - L.1)

- [ ] Translations: graph the image (Geometry - L.2)
- [ ] Translations: find the coordinates (Geometry - L.3)
- [ ] Translations: write the rule (Geometry - L.4)
- [ ] Reflections: graph the image (Geometry - L.5)
- [ ] Reflections: find the coordinates (Geometry - L.6)
- [ ] Rotations: graph the image (Geometry - L.8)
- [ ] Rotations: find the coordinates (Geometry - L.9)
- [ ] Compositions of congruence transformations: graph the image (Geometry - L.10)
- [ ] Congruence transformations: mixed review (Geometry - L.12)
- [ ] Dilations: graph the image (Geometry - L.13)
- [ ] Dilations: find the coordinates (Geometry - L.14)
- [ ] Dilations: scale factor and classification (Geometry - L.15)

9-12.HSG-CO.A.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

- [ ] Transformations that carry a polygon onto itself (Geometry - L.11)
- [ ] Draw lines of symmetry (Geometry - O.3)
- [ ] Count lines of symmetry (Geometry - O.4)

9-12.HSG-CO.A.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

- [ ] Rotate polygons about a point (Geometry - L.7)

9-12.HSG-CO.A.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

- [ ] Translations: graph the image (Geometry - L.2)
- [ ] Reflections: graph the image (Geometry - L.5)
- [ ] Rotations: graph the image (Geometry - L.8)
- [ ] Compositions of congruence transformations: graph the image (Geometry - L.10)

9-12.HSG-CO.B Understand congruence in terms of rigid motions

9-12.HSG-CO.B.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

☐ Transformations that carry a polygon onto itself (Geometry - L.11)

9-12.HSG-CO.B.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

9-12.HSG-CO.B.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.

9-12.HSG-CO.C Prove geometric theorems

9-12.HSG-CO.C.9 Prove theorems about lines and angles.

☐ Proofs involving angles (Geometry - C.8)

☐ Proofs involving parallel lines I (Geometry - D.6)

☐ Proofs involving parallel lines II (Geometry - D.7)

9-12.HSG-CO.C.10 Prove theorems about triangles.

☐ Proving triangles congruent by SSS and SAS (Geometry - K.2)

☐ Proving triangles congruent by ASA and AAS (Geometry - K.4)

☐ SSS Theorem in the coordinate plane (Geometry - K.6)

☐ Proving triangles congruent by SSS, SAS, ASA, and AAS (Geometry - K.7)

☐ Proofs involving isosceles triangles (Geometry - K.10)

☐ Proofs involving triangles I (Geometry - M.8)

☐ Proofs involving triangles II (Geometry - M.9)

9-12.HSG-CO.C.11 Prove theorems about parallelograms.

☐ Proofs involving quadrilaterals I (Geometry - N.11)

☐ Proofs involving quadrilaterals II (Geometry - N.12)

9-12.HSG-CO.D Make geometric constructions

9-12.HSG-CO.D.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

☐ Construct the midpoint or perpendicular bisector of a segment (Geometry - B.10)

☐ Construct an angle bisector (Geometry - C.6)

☐ Construct a congruent angle (Geometry - C.7)

☐ Construct a perpendicular line (Geometry - D.2)

☐ Construct parallel lines (Geometry - D.5)

☐ Construct an equilateral triangle or regular hexagon (Geometry - G.5)

☐ Construct a square (Geometry - G.6)

☐ Construct the circumcenter or incenter of a triangle (Geometry - M.6)

☐ Construct the centroid or orthocenter of a triangle (Geometry - M.7)

☐ Construct a tangent line to a circle (Geometry - U.13)

☐ Construct the inscribed or circumscribed circle of a triangle (Geometry - U.17)

9-12.HSG-CO.D.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

☐ Construct an equilateral triangle inscribed in a circle (Geometry - U.14)

☐ Construct a square inscribed in a circle (Geometry - U.15)

☐ Construct a regular hexagon inscribed in a circle (Geometry - U.16)

9-12.HSG-SRT Similarity, Right Triangles, and Trigonometry

9-12.HSG-SRT.A Understand similarity in terms of similarity transformations

9-12.HSG-SRT.A.1 Verify experimentally the properties of dilations given by a center and a scale factor:

9-12.HSG-SRT.A.1a A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

☐ Dilations and parallel lines (Geometry - L.16)

9-12.HSG-SRT.A.1b The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

- [ ] Dilations and scale factors (Algebra 1 - F.8)
- [ ] Dilations: scale factor and classification (Geometry - L.15)

9-12.HSG-SRT.A.2 Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

- [ ] Similar figures: side lengths and angle measures (Algebra 1 - F.6)
- [ ] Identify similar figures (Geometry - P.3)
- [ ] Side lengths and angle measures in similar figures (Geometry - P.4)
- [ ] Similar triangles and similarity transformations (Geometry - P.8)
- [ ] Similarity of circles (Geometry - P.9)

9-12.HSG-SRT.A.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

- [ ] Similar triangles and indirect measurement (Algebra 1 - F.7)
- [ ] Similar triangles and indirect measurement (Geometry - P.5)
- [ ] Similarity rules for triangles (Geometry - P.7)

9-12.HSG-SRT.B Prove theorems involving similarity

9-12.HSG-SRT.B.4 Prove theorems about triangles.

- [ ] Proofs involving triangles I (Geometry - M.8)
- [ ] Proofs involving triangles II (Geometry - M.9)
- [ ] Proofs involving similarity in right triangles (Geometry - P.14)
- [ ] Prove the Pythagorean theorem (Geometry - P.15)

9-12.HSG-SRT.B.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

- [ ] Similar triangles and indirect measurement (Algebra 1 - F.7)

- [ ] SSS and SAS Theorems (Geometry - K.1)

- [ ] Proving triangles congruent by SSS and SAS (Geometry - K.2)

- [ ] ASA and AAS Theorems (Geometry - K.3)

- [ ] Proving triangles congruent by ASA and AAS (Geometry - K.4)

- [ ] SSS, SAS, ASA, and AAS Theorems (Geometry - K.5)

- [ ] SSS Theorem in the coordinate plane (Geometry - K.6)

- [ ] Proving triangles congruent by SSS, SAS, ASA, and AAS (Geometry - K.7)

- [ ] Proofs involving corresponding parts of congruent triangles (Geometry - K.8)

- [ ] Congruency in isosceles and equilateral triangles (Geometry - K.9)

- [ ] Proofs involving isosceles triangles (Geometry - K.10)

- [ ] Hypotenuse-Leg Theorem (Geometry - K.11)

- [ ] Similar triangles and indirect measurement (Geometry - P.5)

- [ ] Similarity rules for triangles (Geometry - P.7)

- [ ] Triangle Proportionality Theorem (Geometry - P.10)

- [ ] Prove similarity statements (Geometry - P.12)

- [ ] Prove proportions or angle congruences using similarity (Geometry - P.13)

9-12.HSG-SRT.C Define trigonometric ratios and solve problems involving right triangles

9-12.HSG-SRT.C.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

- [ ] Trigonometric ratios: sin, cos, and tan (Algebra 1 - HH.1)

- [ ] Trigonometric ratios: sin, cos, and tan (Geometry - R.1)

- [ ] Trigonometric ratios: csc, sec, and cot (Geometry - R.2)

- [ ] Trigonometric ratios in similar right triangles (Geometry - R.3)

- [ ] Trigonometric ratios: sin, cos, and tan (Algebra 2 - Y.3)

- [ ] Trigonometric ratios: csc, sec, and cot (Algebra 2 - Y.4)

- [ ] Trigonometric ratios in similar right triangles (Algebra 2 - Y.5)

- [ ] Find trigonometric ratios using right triangles (Precalculus - M.5)

9-12.HSG-SRT.C.7 Explain and use the relationship between the sine and cosine of complementary angles.

☐ Trigonometric functions of complementary angles (Geometry - R.4)

☐ Complementary angle identities (Algebra 2 - AA.1)

☐ Complementary angle identities (Precalculus - O.1)

9-12.HSG-SRT.C.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

☐ Pythagorean theorem: word problems (Algebra 1 - F.15)

☐ Trigonometric ratios: find a side length (Algebra 1 - HH.4)

☐ Trigonometric ratios: find an angle measure (Algebra 1 - HH.5)

☐ Solve a right triangle (Algebra 1 - HH.6)

☐ Pythagorean Theorem (Geometry - Q.1)

☐ Converse of the Pythagorean theorem (Geometry - Q.2)

☐ Pythagorean Inequality Theorems (Geometry - Q.3)

☐ Trigonometric ratios: find a side length (Geometry - R.8)

☐ Trigonometric ratios: find an angle measure (Geometry - R.9)

☐ Solve a right triangle (Geometry - R.10)

☐ Pythagorean Theorem and its converse (Algebra 2 - Y.1)

☐ Trigonometric ratios: find a side length (Algebra 2 - Y.14)

☐ Trigonometric ratios: find an angle measure (Algebra 2 - Y.15)

☐ Solve a right triangle (Algebra 2 - Y.16)

☐ Trigonometric ratios: find a side length (Precalculus - M.10)

☐ Trigonometric ratios: find an angle measure (Precalculus - M.11)

☐ Solve a right triangle (Precalculus - M.12)

9-12.HSG-SRT.D Apply trigonometry to general triangles

9-12.HSG-SRT.D.9 Derive the formula A = 1/2 ab sin(C) for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

☐ Area of a triangle: sine formula (Algebra 2 - Y.20)

- [ ] Area of a triangle: Law of Sines (Algebra 2 - Y.21)
- [ ] Area of a triangle: sine formula (Precalculus - M.16)

9-12.HSG-SRT.D.10 Prove the Laws of Sines and Cosines and use them to solve problems.

- [ ] Law of Sines (Geometry - R.11)
- [ ] Law of Cosines (Geometry - R.12)
- [ ] Law of Sines (Algebra 2 - Y.17)
- [ ] Law of Cosines (Algebra 2 - Y.18)
- [ ] Area of a triangle: sine formula (Algebra 2 - Y.20)
- [ ] Area of a triangle: Law of Sines (Algebra 2 - Y.21)
- [ ] Law of Sines (Precalculus - M.13)
- [ ] Law of Cosines (Precalculus - M.14)
- [ ] Area of a triangle: sine formula (Precalculus - M.16)

9-12.HSG-SRT.D.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

- [ ] Solve a triangle (Geometry - R.13)
- [ ] Solve a triangle (Algebra 2 - Y.19)
- [ ] Solve a triangle (Precalculus - M.15)

9-12.HSG-C Circles

9-12.HSG-C.A Understand and apply theorems about circles

9-12.HSG-C.A.1 Prove that all circles are similar.

9-12.HSG-C.A.2 Identify and describe relationships among inscribed angles, radii, and chords.

- [ ] Arcs and chords (Geometry - U.6)
- [ ] Inscribed angles (Geometry - U.9)

9-12.HSG-C.A.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

☐ Construct the circumcenter or incenter of a triangle (Geometry - M.6)

☐ Angles in inscribed quadrilaterals I (Geometry - U.11)

☐ Angles in inscribed quadrilaterals II (Geometry - U.12)

☐ Construct the inscribed or circumscribed circle of a triangle (Geometry - U.17)

9-12.HSG-C.A.4 Construct a tangent line from a point outside a given circle to the circle.

☐ Tangent lines (Geometry - U.7)

☐ Construct a tangent line to a circle (Geometry - U.13)

9-12.HSG-C.B Find arc lengths and areas of sectors of circles

9-12.HSG-C.B.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

☐ Arc measure and arc length (Geometry - U.3)

☐ Area of sectors (Geometry - U.4)

☐ Convert between radians and degrees (Algebra 2 - X.1)

☐ Radians and arc length (Algebra 2 - X.2)

☐ Convert between radians and degrees (Precalculus - M.1)

☐ Radians and arc length (Precalculus - M.2)

9-12.HSG-GPE Expressing Geometric Properties with Equations

9-12.HSG-GPE.A Translate between the geometric description and the equation for a conic section

9-12.HSG-GPE.A.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

☐ Write equations of circles in standard form using properties (Geometry - V.4)

☐ Convert equations of circles from general to standard form (Geometry - V.5)

☐ Find properties of circles from equations in general form (Geometry - V.6)

☐ Graph circles from equations in standard form (Geometry - V.7)

☐ Write equations of circles in standard form using properties (Algebra 2 - U.4)

☐ Convert equations of circles from general to standard form (Algebra 2 - U.5)

☐ Find properties of circles (Precalculus - P.4)

☐ Write equations of circles in standard form (Precalculus - P.5)

9-12.HSG-GPE.A.2 Derive the equation of a parabola given a focus and directrix.

☐ Write equations of parabolas in vertex form using properties (Algebra 2 - T.6)

☐ Write equations of parabolas in vertex form (Precalculus - P.2)

9-12.HSG-GPE.A.3 Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

☐ Write equations of ellipses in standard form using properties (Algebra 2 - V.5)

☐ Write equations of hyperbolas in standard form using properties (Algebra 2 - W.7)

☐ Write equations of ellipses in standard form (Precalculus - P.9)

☐ Write equations of hyperbolas in standard form (Precalculus - P.12)

9-12.HSG-GPE.B Use coordinates to prove simple geometric theorems algebraically

9-12.HSG-GPE.B.4 Use coordinates to prove simple geometric theorems algebraically.

9-12.HSG-GPE.B.5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

☐ Slopes of parallel and perpendicular lines (Algebra 1 - S.23)

☐ Write an equation for a parallel or perpendicular line (Algebra 1 - S.24)

☐ Slopes of parallel and perpendicular lines (Geometry - E.5)

☐ Equations of parallel and perpendicular lines (Geometry - E.6)

☐ Find the distance between two parallel lines (Geometry - E.8)

9-12.HSG-GPE.B.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

<div style="margin-left:2em">

☐ Midpoint formula - find the midpoint (Algebra 1 - G.2)

☐ Midpoints (Geometry - B.4)

☐ Midpoint formula - find the midpoint (Geometry - B.7)

</div>

9-12.HSG-GPE.B.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

<div style="margin-left:2em">

☐ Distance formula (Geometry - B.9)

☐ Area and perimeter in the coordinate plane I (Geometry - S.5)

☐ Area and perimeter in the coordinate plane II (Geometry - S.6)

</div>

9-12.HSG-GMD Geometric Measurement and Dimension

9-12.HSG-GMD.A Explain volume formulas and use them to solve problems

9-12.HSG-GMD.A.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.

9-12.HSG-GMD.A.2 Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

9-12.HSG-GMD.A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

<div style="margin-left:2em">

☐ Volume (Algebra 1 - F.4)

☐ Volume of prisms and cylinders (Geometry - T.4)

☐ Volume of pyramids and cones (Geometry - T.5)

☐ Surface area and volume of spheres (Geometry - T.6)

</div>

9-12.HSG-GMD.B Visualize relationships between two-dimensional and three-dimensional objects

9-12.HSG-GMD.B.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

☐ Cross-sections of three-dimensional figures (Geometry - H.4)

☐ Solids of revolution (Geometry - H.5)

9-12.HSG-MG Modeling with Geometry

9-12.HSG-MG.A Apply geometric concepts in modeling situations

☐ Area and perimeter: word problems (Algebra 1 - F.3)

9-12.HSG-MG.A.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

9-12.HSG-MG.A.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).

9-12.HSG-MG.A.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

9-12.HSS Statistics and Probability

9-12.HSS-ID Interpreting Categorical and Quantitative Data

9-12.HSS-ID.A Summarize, represent, and interpret data on a single count or measurement variable

9-12.HSS-ID.A.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).

☐ Create bar graphs, line graphs, and histograms (Algebra 1 - N.2)

9-12.HSS-ID.A.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

☐ Mean, median, mode, and range (Algebra 1 - KK.2)

☐ Quartiles (Algebra 1 - KK.3)

☐ Mean absolute deviation (Algebra 1 - KK.6)

☐ Variance and standard deviation (Algebra 1 - KK.7)

☐ Variance and standard deviation (Algebra 2 - EE.2)

☐ Variance and standard deviation (Precalculus - Z.2)

9-12.HSS-ID.A.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

☐ Interpret box-and-whisker plots (Algebra 1 - N.5)

☐ Identify an outlier (Algebra 1 - KK.4)

☐ Identify an outlier and describe the effect of removing it (Algebra 1 - KK.5)

☐ Identify an outlier (Algebra 2 - EE.3)

☐ Identify an outlier and describe the effect of removing it (Algebra 2 - EE.4)

☐ Identify an outlier (Precalculus - Z.3)

☐ Identify an outlier and describe the effect of removing it (Precalculus - Z.4)

9-12.HSS-ID.A.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

☐ Find probabilities using the normal distribution I (Algebra 2 - DD.11)

☐ Find probabilities using the normal distribution (Precalculus - Y.12)

☐ Find z-values (Precalculus - Y.13)

☐ Find values of normal variables (Precalculus - Y.14)

☐ Distributions of sample means (Precalculus - Y.15)

☐ The Central Limit Theorem (Precalculus - Y.16)

9-12.HSS-ID.B Summarize, represent, and interpret data on two categorical and quantitative variables

9-12.HSS-ID.B.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

9-12.HSS-ID.B.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

9-12.HSS-ID.B.6a Fit a function to the data; use functions fitted to data to solve problems in the context of the data.

☐ Find the equation of a regression line (Algebra 1 - KK.13)

☐ Interpret regression lines (Algebra 1 - KK.14)

☐ Analyze a regression line of a data set (Algebra 1 - KK.15)

☐ Find the equation of a regression line (Algebra 2 - EE.6)

☐ Interpret regression lines (Algebra 2 - EE.7)

☐ Analyze a regression line of a data set (Algebra 2 - EE.8)

☐ Find the equation of a regression line (Precalculus - Z.8)

☐ Interpret regression lines (Precalculus - Z.9)

☐ Analyze a regression line of a data set (Precalculus - Z.10)

☐ Analyze a regression line using statistics of a data set (Precalculus - Z.11)

9-12.HSS-ID.B.6b Informally assess the fit of a function by plotting and analyzing residuals.

☐ Interpret a scatter plot (Algebra 1 - KK.8)

9-12.HSS-ID.B.6c Fit a linear function for a scatter plot that suggests a linear association.

☐ Scatter plots: line of best fit (Algebra 1 - KK.12)

9-12.HSS-ID.C Interpret linear models

9-12.HSS-ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

☐ Interpret regression lines (Algebra 1 - KK.14)

☐ Analyze a regression line of a data set (Algebra 1 - KK.15)

☐ Interpret regression lines (Algebra 2 - EE.7)

☐ Analyze a regression line of a data set (Algebra 2 - EE.8)

☐ Interpret regression lines (Precalculus - Z.9)

☐ Analyze a regression line using statistics of a data set (Precalculus - Z.11)

9-12.HSS-ID.C.8 Compute (using technology) and interpret the correlation coefficient of a linear fit.

    ☐ Match correlation coefficients to scatter plots (Algebra 1 - KK.10)

    ☐ Calculate correlation coefficients (Algebra 1 - KK.11)

    ☐ Match correlation coefficients to scatter plots (Precalculus - Z.6)

    ☐ Calculate correlation coefficients (Precalculus - Z.7)

9-12.HSS-ID.C.9 Distinguish between correlation and causation.

9-12.HSS-IC Making Inferences and Justifying Conclusions

9-12.HSS-IC.A Understand and evaluate random processes underlying statistical experiments

9-12.HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

    ☐ Identify biased samples (Algebra 1 - KK.1)

    ☐ Identify biased samples (Algebra 2 - EE.1)

    ☐ Identify biased samples (Precalculus - Z.1)

9-12.HSS-IC.A.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.

9-12.HSS-IC.B Make inferences and justify conclusions from sample surveys, experiments, and observational studies

9-12.HSS-IC.B.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

    ☐ Experiment design (Algebra 2 - EE.12)

    ☐ Experiment design (Precalculus - Z.15)

9-12.HSS-IC.B.4 Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

    ☐ Find confidence intervals for population means (Algebra 2 - EE.9)

☐ Find confidence intervals for population proportions (Algebra 2 - EE.10)

☐ Find confidence intervals for population means (Precalculus - Z.12)

☐ Find confidence intervals for population proportions (Precalculus - Z.13)

9-12.HSS-IC.B.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

☐ Analyze the results of an experiment using simulations (Precalculus - Z.16)

9-12.HSS-IC.B.6 Evaluate reports based on data.

☐ Interpret confidence intervals for population means (Algebra 2 - EE.11)

☐ Analyze the results of an experiment using simulations (Algebra 2 - EE.13)

☐ Interpret confidence intervals for population means (Precalculus - Z.14)

☐ Analyze the results of an experiment using simulations (Precalculus - Z.16)

9-12.HSS-CP Conditional Probability and the Rules of Probability

9-12.HSS-CP.A Understand independence and conditional probability and use them to interpret data

9-12.HSS-CP.A.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").

☐ Theoretical probability (Algebra 1 - JJ.1)

☐ Compound events: find the number of outcomes (Algebra 1 - JJ.3)

☐ Theoretical and experimental probability (Geometry - X.1)

☐ Compound events: find the number of outcomes (Geometry - X.2)

☐ Calculate probabilities of events (Algebra 2 - CC.2)

☐ Calculate probabilities of events (Precalculus - X.2)

9-12.HSS-CP.A.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

☐ Identify independent and dependent events (Algebra 1 - JJ.4)

☐ Probability of independent and dependent events (Algebra 1 - JJ.5)

☐ Independent and dependent events (Geometry - X.3)

☐ Identify independent events (Algebra 2 - CC.7)

☐ Probability of independent and dependent events (Algebra 2 - CC.8)

☐ Identify independent events (Precalculus - X.6)

9-12.HSS-CP.A.3 Understand the conditional probability of A given B as P(A and B)/P(B), and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

☐ Find conditional probabilities (Algebra 2 - CC.9)

☐ Independence and conditional probability (Algebra 2 - CC.10)

☐ Find conditional probabilities (Precalculus - X.7)

☐ Independence and conditional probability (Precalculus - X.8)

9-12.HSS-CP.A.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.

☐ Find probabilities using two-way frequency tables (Algebra 2 - CC.6)

☐ Find conditional probabilities using two-way frequency tables (Algebra 2 - CC.11)

☐ Find probabilities using two-way frequency tables (Precalculus - X.5)

☐ Find conditional probabilities using two-way frequency tables (Precalculus - X.9)

9-12.HSS-CP.A.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

9-12.HSS-CP.B Use the rules of probability to compute probabilities of compound events in a uniform probability model

9-12.HSS-CP.B.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.

☐ Geometric probability (Geometry - X.7)

☐ Find conditional probabilities (Algebra 2 - CC.9)

☐ Find conditional probabilities using two-way frequency tables (Algebra 2 - CC.11)

☐ Find conditional probabilities (Precalculus - X.7)

☐ Find conditional probabilities using two-way frequency tables (Precalculus - X.9)

9-12.HSS-CP.B.7 Apply the Addition Rule, P(A or B) = P(A) + P(B) — P(A and B), and interpret the answer in terms of the model.

☐ Find probabilities using the addition rule (Algebra 2 - CC.12)

☐ Find probabilities using the addition rule (Precalculus - X.10)

9-12.HSS-CP.B.8 Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.

☐ Find conditional probabilities (Algebra 2 - CC.9)

☐ Find conditional probabilities (Precalculus - X.7)

9-12.HSS-CP.B.9 Use permutations and combinations to compute probabilities of compound events and solve problems.

☐ Permutations (Algebra 1 - JJ.6)

☐ Counting principle (Algebra 1 - JJ.7)

☐ Permutation and combination notation (Algebra 1 - JJ.8)

☐ Counting principle (Geometry - X.4)

☐ Permutations (Geometry - X.5)

☐ Permutation and combination notation (Geometry - X.6)

☐ Counting principle (Algebra 2 - CC.3)

☐ Combinations and permutations (Algebra 2 - CC.4)

☐ Find probabilities using combinations and permutations (Algebra 2 - CC.5)

☐ Combinations and permutations (Precalculus - X.3)

☐ Find probabilities using combinations and permutations (Precalculus - X.4)

9-12.HSS-MD Using Probability to Make Decisions

9-12.HSS-MD.A Calculate expected values and use them to solve problems

9-12.HSS-MD.A.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

☐ Write a discrete probability distribution (Algebra 2 - DD.2)

☐ Graph a discrete probability distribution (Algebra 2 - DD.3)

☐ Write a discrete probability distribution (Precalculus - Y.2)

☐ Graph a discrete probability distribution (Precalculus - Y.3)

9-12.HSS-MD.A.2 Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

☐ Expected values of random variables (Algebra 2 - DD.4)

☐ Expected values of random variables (Precalculus - Y.4)

9-12.HSS-MD.A.3 Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.

☐ Write the probability distribution for a game of chance (Algebra 2 - DD.7)

☐ Expected values for a game of chance (Algebra 2 - DD.8)

☐ Write the probability distribution for a game of chance (Precalculus - Y.7)

☐ Expected values for a game of chance (Precalculus - Y.8)

9-12.HSS-MD.A.4 Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

9-12.HSS-MD.B Use probability to evaluate outcomes of decisions

9-12.HSS-MD.B.5 Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

9-12.HSS-MD.B.5a Find the expected payoff for a game of chance.

☐ Expected values for a game of chance (Algebra 2 - DD.8)

☐ Expected values for a game of chance (Precalculus - Y.8)

9-12.HSS-MD.B.5b Evaluate and compare strategies on the basis of expected values.

☐ Choose the better bet (Algebra 2 - DD.9)

☐ Choose the better bet (Precalculus - Y.9)

9-12.HSS-MD.B.6 Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

9-12.HSS-MD.B.7 Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

☐ Choose the better bet (Algebra 2 - DD.9)

☐ Choose the better bet (Precalculus - Y.9)

Common Core Skill Alignment

HIGH SCHOOL: MATHEMATICAL PRACTICES

MP1 Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

- [ ] Area and perimeter: word problems (Algebra 1 - F.3)
- [ ] Pythagorean theorem: word problems (Algebra 1 - F.15)
- [ ] Rate of travel: word problems (Algebra 1 - O.4)
- [ ] Solve a system of equations using any method: word problems (Algebra 1 - U.15)
- [ ] Exponential growth and decay: word problems (Algebra 1 - X.5)
- [ ] Analyze a regression line of a data set (Algebra 1 - KK.15)
- [ ] Solve a triangle (Geometry - R.13)
- [ ] Solve a system of equations using any method: word problems (Algebra 2 - E.11)
- [ ] Exponential growth and decay: word problems (Algebra 2 - S.12)
- [ ] Compound interest: word problems (Algebra 2 - S.13)
- [ ] Solve a triangle (Algebra 2 - Y.19)
- [ ] Expected values for a game of chance (Algebra 2 - DD.8)
- [ ] Choose the better bet (Algebra 2 - DD.9)
- [ ] Analyze a regression line of a data set (Algebra 2 - EE.8)
- [ ] Analyze the results of an experiment using simulations (Algebra 2 - EE.13)
- [ ] Exponential growth and decay: word problems (Precalculus - F.16)

- [ ] Compound interest: word problems (Precalculus - F.17)
- [ ] Solve a triangle (Precalculus - M.15)
- [ ] Expected values for a game of chance (Precalculus - Y.8)
- [ ] Choose the better bet (Precalculus - Y.9)
- [ ] Analyze a regression line using statistics of a data set (Precalculus - Z.11)
- [ ] Analyze the results of an experiment using simulations (Precalculus - Z.16)

MP2 Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize-to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents-and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

- [ ] Convert rates and measurements: customary units (Algebra 1 - E.1)
- [ ] Convert rates and measurements: metric units (Algebra 1 - E.2)
- [ ] Write variable equations (Algebra 1 - I.4)
- [ ] Rearrange multi-variable equations (Algebra 1 - I.8)
- [ ] Write and solve equations that represent diagrams (Algebra 1 - J.2)
- [ ] Consecutive integer problems (Algebra 1 - O.3)
- [ ] Weighted averages: word problems (Algebra 1 - O.5)
- [ ] Write direct variation equations (Algebra 1 - R.4)
- [ ] Write inverse variation equations (Algebra 1 - R.7)
- [ ] Write and solve inverse variation equations (Algebra 1 - R.8)
- [ ] Slope-intercept form: write an equation from a word problem (Algebra 1 - S.10)
- [ ] Write linear functions to solve word problems (Algebra 1 - S.12)
- [ ] Interpret regression lines (Algebra 1 - KK.14)
- [ ] Write variable expressions (Geometry - A.5)

- [ ] Cross-sections of three-dimensional figures (Geometry - H.4)
- [ ] Solids of revolution (Geometry - H.5)
- [ ] Convert rates and measurements: customary units (Geometry - W.1)
- [ ] Convert rates and measurements: metric units (Geometry - W.2)
- [ ] Solve multi-variable equations (Algebra 2 - B.6)
- [ ] Write and solve direct variation equations (Algebra 2 - Q.1)
- [ ] Write and solve inverse variation equations (Algebra 2 - Q.2)
- [ ] Convert between radians and degrees (Algebra 2 - X.1)
- [ ] Radians and arc length (Algebra 2 - X.2)
- [ ] Interpret regression lines (Algebra 2 - EE.7)
- [ ] Convert between radians and degrees (Precalculus - M.1)
- [ ] Radians and arc length (Precalculus - M.2)
- [ ] Convert complex numbers between rectangular and polar form (Precalculus - T.4)
- [ ] Interpret regression lines (Precalculus - Z.9)

MP3 Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and-if there is a flaw in an argument-explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

- [ ] Identify biased samples (Algebra 1 - KK.1)
- [ ] Proofs involving angles (Geometry - C.8)
- [ ] Proofs involving parallel lines I (Geometry - D.6)

- [ ] Proofs involving parallel lines II (Geometry - D.7)

- [ ] Proving triangles congruent by SSS and SAS (Geometry - K.2)

- [ ] Proving triangles congruent by ASA and AAS (Geometry - K.4)

- [ ] Proving triangles congruent by SSS, SAS, ASA, and AAS (Geometry - K.7)

- [ ] Proofs involving corresponding parts of congruent triangles (Geometry - K.8)

- [ ] Proofs involving triangles I (Geometry - M.8)

- [ ] Proofs involving triangles II (Geometry - M.9)

- [ ] Proofs involving quadrilaterals I (Geometry - N.11)

- [ ] Proofs involving quadrilaterals II (Geometry - N.12)

- [ ] Prove similarity statements (Geometry - P.12)

- [ ] Prove the Pythagorean theorem (Geometry - P.15)

- [ ] Identify biased samples (Algebra 2 - EE.1)

- [ ] Interpret confidence intervals for population means (Algebra 2 - EE.11)

- [ ] Experiment design (Algebra 2 - EE.12)

- [ ] Identify biased samples (Precalculus - Z.1)

- [ ] Interpret confidence intervals for population means (Precalculus - Z.14)

- [ ] Experiment design (Precalculus - Z.15)

MP4 Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

- [ ] Scale drawings: word problems (Algebra 1 - C.7)

- [ ] Solve linear equations: word problems (Algebra 1 - J.10)
- [ ] Interpret the graph of a function: word problems (Algebra 1 - Q.11)
- [ ] Solve a system of equations by graphing: word problems (Algebra 1 - U.3)
- [ ] Solve a system of equations using any method: word problems (Algebra 1 - U.15)
- [ ] Exponential growth and decay: word problems (Algebra 1 - X.5)
- [ ] Probability of independent and dependent events (Algebra 1 - JJ.5)
- [ ] Find the equation of a regression line (Algebra 1 - KK.13)
- [ ] Scale drawings: word problems (Geometry - A.2)
- [ ] Solve linear equations: word problems (Algebra 2 - B.2)
- [ ] Solve a system of equations using any method: word problems (Algebra 2 - E.11)
- [ ] Exponential growth and decay: word problems (Algebra 2 - S.12)
- [ ] Compound interest: word problems (Algebra 2 - S.13)
- [ ] Find probabilities using two-way frequency tables (Algebra 2 - CC.6)
- [ ] Probability of independent and dependent events (Algebra 2 - CC.8)
- [ ] Find conditional probabilities using two-way frequency tables (Algebra 2 - CC.11)
- [ ] Write the probability distribution for a game of chance (Algebra 2 - DD.7)
- [ ] Find the equation of a regression line (Algebra 2 - EE.6)
- [ ] Interpret confidence intervals for population means (Algebra 2 - EE.11)
- [ ] Exponential growth and decay: word problems (Precalculus - F.16)
- [ ] Compound interest: word problems (Precalculus - F.17)
- [ ] Solve a system of equations by graphing: word problems (Precalculus - I.2)
- [ ] Find probabilities using two-way frequency tables (Precalculus - X.5)
- [ ] Find conditional probabilities using two-way frequency tables (Precalculus - X.9)
- [ ] Write the probability distribution for a game of chance (Precalculus - Y.7)
- [ ] Find the equation of a regression line (Precalculus - Z.8)
- [ ] Interpret confidence intervals for population means (Precalculus - Z.14)

MP5 Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

- [ ] Model and solve equations using algebra tiles (Algebra 1 - J.1)
- [ ] Complete a table and graph a linear function (Algebra 1 - S.13)
- [ ] Solve a system of equations by graphing (Algebra 1 - U.2)
- [ ] Model polynomials with algebra tiles (Algebra 1 - Z.2)
- [ ] Add and subtract polynomials using algebra tiles (Algebra 1 - Z.3)
- [ ] Multiply two polynomials using algebra tiles (Algebra 1 - Z.7)
- [ ] Characteristics of quadratic functions (Algebra 1 - BB.1)
- [ ] Find the equation of a regression line (Algebra 1 - KK.13)
- [ ] Translations: graph the image (Geometry - L.2)
- [ ] Reflections: graph the image (Geometry - L.5)
- [ ] Rotations: graph the image (Geometry - L.8)
- [ ] Dilations: graph the image (Geometry - L.13)
- [ ] Construct an equilateral triangle inscribed in a circle (Geometry - U.14)
- [ ] Construct a square inscribed in a circle (Geometry - U.15)
- [ ] Construct a regular hexagon inscribed in a circle (Geometry - U.16)
- [ ] Compass directions and vectors (Geometry - Y.1)
- [ ] Graph a resultant vector using the triangle method (Geometry - Y.5)
- [ ] Graph a resultant vector using the parallelogram method (Geometry - Y.6)
- [ ] Complete a table for a function graph (Algebra 2 - D.5)
- [ ] Solve a system of equations by graphing (Algebra 2 - E.2)
- [ ] Transformation matrices: graph the image (Algebra 2 - G.17)
- [ ] Characteristics of quadratic functions (Algebra 2 - J.1)

- [ ] Find properties of sine functions (Algebra 2 - Z.1)

- [ ] Find properties of cosine functions (Algebra 2 - Z.5)

- [ ] Find probabilities using the normal distribution I (Algebra 2 - DD.11)

- [ ] Find probabilities using the normal distribution II (Algebra 2 - DD.12)

- [ ] Find the equation of a regression line (Algebra 2 - EE.6)

- [ ] Characteristics of quadratic functions (Precalculus - C.2)

- [ ] Solve a system of equations by graphing (Precalculus - I.1)

- [ ] Transformation matrices: graph the image (Precalculus - L.18)

- [ ] Find properties of sine functions (Precalculus - N.1)

- [ ] Find properties of cosine functions (Precalculus - N.5)

- [ ] Addition in the complex plane (Precalculus - S.3)

- [ ] Subtraction in the complex plane (Precalculus - S.4)

- [ ] Midpoints in the complex plane (Precalculus - S.7)

- [ ] Distance in the complex plane (Precalculus - S.8)

- [ ] Graph a resultant vector using the triangle method (Precalculus - U.5)

- [ ] Graph a resultant vector using the parallelogram method (Precalculus - U.6)

- [ ] Find probabilities using the normal distribution (Precalculus - Y.12)

- [ ] Find the equation of a regression line (Precalculus - Z.8)

MP6 Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

- [ ] Classify rational and irrational numbers (Algebra 1 - A.9)

- [ ] Precision (Algebra 1 - E.4)

- [ ] Greatest possible error (Algebra 1 - E.5)

- [ ] Minimum and maximum area and volume (Algebra 1 - E.6)

- [ ] Percent error (Algebra 1 - E.7)

- [ ] Percent error: area and volume (Algebra 1 - E.8)

- [ ] Solve equations: complete the solution (Algebra 1 - J.7)

- [ ] Identify functions (Algebra 1 - Q.4)

- [ ] Polynomial vocabulary (Algebra 1 - Z.1)

- [ ] Describe linear and exponential growth and decay (Algebra 1 - CC.6)

- [ ] Domain and range of absolute value functions: graphs (Algebra 1 - DD.3)

- [ ] Domain and range of absolute value functions: equations (Algebra 1 - DD.4)

- [ ] Match correlation coefficients to scatter plots (Algebra 1 - KK.10)

- [ ] Dilations: scale factor and classification (Geometry - L.15)

- [ ] Precision (Geometry - W.4)

- [ ] Greatest possible error (Geometry - W.5)

- [ ] Minimum and maximum area and volume (Geometry - W.6)

- [ ] Percent error (Geometry - W.7)

- [ ] Percent error: area and volume (Geometry - W.8)

- [ ] Solve equations: complete the solution (Algebra 2 - B.3)

- [ ] Identify functions (Algebra 2 - D.2)

- [ ] Properties of matrices (Algebra 2 - G.8)

- [ ] Polynomial vocabulary (Algebra 2 - K.1)

- [ ] Domain and range of radical functions (Algebra 2 - L.12)

- [ ] Identify inverse functions (Algebra 2 - O.8)

- [ ] Describe function transformations (Algebra 2 - P.6)

- [ ] Domain and range of exponential and logarithmic functions (Algebra 2 - S.1)

- [ ] Describe linear and exponential growth and decay (Algebra 2 - S.11)

- [ ] Identify an outlier and describe the effect of removing it (Algebra 2 - EE.4)

- [ ] Identify functions (Precalculus - A.2)

- [ ] Identify inverse functions (Precalculus - A.13)

- [ ] Describe function transformations (Precalculus - B.6)

- [ ] Domain and range of exponential and logarithmic functions (Precalculus - F.1)

- [ ] Describe linear and exponential growth and decay (Precalculus - F.15)
- [ ] Domain and range of radical functions (Precalculus - G.1)
- [ ] Properties of matrices (Precalculus - L.8)
- [ ] Classify rational and irrational numbers (Precalculus - Q.2)
- [ ] Identify an outlier and describe the effect of removing it (Precalculus - Z.4)

MP7 Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

- [ ] Solve a system of equations using augmented matrices: word problems (Algebra 1 - U.13)
- [ ] Factor quadratics with other leading coefficients (Algebra 1 - AA.5)
- [ ] Factor quadratics: special cases (Algebra 1 - AA.6)
- [ ] Factor by grouping (Algebra 1 - AA.7)
- [ ] Solve a quadratic equation by factoring (Algebra 1 - BB.7)
- [ ] Complete the square (Algebra 1 - BB.8)
- [ ] Solve a quadratic equation by completing the square (Algebra 1 - BB.9)
- [ ] Simplify radical expressions: mixed review (Algebra 1 - EE.8)
- [ ] Simplify rational expressions (Algebra 1 - GG.3)
- [ ] Properties of exponents (Geometry - A.3)
- [ ] Solve a quadratic equation by factoring (Geometry - A.9)
- [ ] Arcs and chords (Geometry - U.6)
- [ ] Inscribed angles (Geometry - U.9)

- [ ] Angles in inscribed quadrilaterals I (Geometry - U.11)

- [ ] Angles in inscribed quadrilaterals II (Geometry - U.12)

- [ ] Find properties of circles from equations in general form (Geometry - V.6)

- [ ] Solve a system of equations using augmented matrices: word problems (Algebra 2 - G.19)

- [ ] Add, subtract, multiply, and divide complex numbers (Algebra 2 - H.6)

- [ ] Factor quadratics (Algebra 2 - I.3)

- [ ] Factor using a quadratic pattern (Algebra 2 - I.4)

- [ ] Factor by grouping (Algebra 2 - I.5)

- [ ] Factor sums and differences of cubes (Algebra 2 - I.6)

- [ ] Solve a quadratic equation by factoring (Algebra 2 - J.6)

- [ ] Complete the square (Algebra 2 - J.7)

- [ ] Solve a quadratic equation by completing the square (Algebra 2 - J.8)

- [ ] Write a quadratic function from its zeros (Algebra 2 - J.12)

- [ ] Write a polynomial from its roots (Algebra 2 - K.9)

- [ ] Multiplication with rational exponents (Algebra 2 - M.2)

- [ ] Division with rational exponents (Algebra 2 - M.3)

- [ ] Simplify expressions involving rational exponents I (Algebra 2 - M.5)

- [ ] Simplify expressions involving rational exponents II (Algebra 2 - M.6)

- [ ] Simplify rational expressions (Algebra 2 - N.4)

- [ ] Solve exponential equations using common logarithms (Algebra 2 - S.5)

- [ ] Solve exponential equations using natural logarithms (Algebra 2 - S.6)

- [ ] Write equations of parabolas in vertex form using properties (Algebra 2 - T.6)

- [ ] Write equations of circles in standard form using properties (Algebra 2 - U.4)

- [ ] Find properties of circles from equations in general form (Algebra 2 - U.6)

- [ ] Write equations of ellipses in standard form using properties (Algebra 2 - V.5)

- [ ] Write equations of hyperbolas in standard form using properties (Algebra 2 - W.7)

- [ ] Write equations of sine functions using properties (Algebra 2 - Z.3)

- [ ] Write equations of cosine functions using properties (Algebra 2 - Z.7)

- [ ] Solve a quadratic equation by factoring (Precalculus - C.6)

- [ ] Solve a quadratic equation by completing the square (Precalculus - C.7)

- [ ] Write a polynomial from its roots (Precalculus - D.5)

- [ ] Operations with rational exponents (Precalculus - H.5)

- [ ] Write equations of sine functions using properties (Precalculus - N.3)

- [ ] Write equations of cosine functions using properties (Precalculus - N.7)

- [ ] Add, subtract, multiply, and divide complex numbers (Precalculus - R.4)

MP8 Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

- [ ] Arithmetic sequences (Algebra 1 - P.2)

- [ ] Geometric sequences (Algebra 1 - P.3)

- [ ] Write variable expressions for arithmetic sequences (Algebra 1 - P.5)

- [ ] Write variable expressions for geometric sequences (Algebra 1 - P.6)

- [ ] Find the constant of variation (Algebra 1 - R.2)

- [ ] Find the slope of a graph (Algebra 1 - S.2)

- [ ] Identify linear, quadratic, and exponential functions from graphs (Algebra 1 - CC.1)

- [ ] Identify linear, quadratic, and exponential functions from tables (Algebra 1 - CC.2)

- [ ] Slopes of lines (Geometry - E.2)

- [ ] Find the slope of a linear function (Algebra 2 - D.6)

- [ ] Powers of i (Algebra 2 - H.8)

- [ ] Pascal's triangle (Algebra 2 - K.16)

- [ ] Pascal's triangle and the Binomial Theorem (Algebra 2 - K.17)

- [ ] Binomial Theorem I (Algebra 2 - K.18)

- [ ] Binomial Theorem II (Algebra 2 - K.19)

- [ ] Function transformation rules (Algebra 2 - P.1)

- [ ] Find terms of an arithmetic sequence (Algebra 2 - BB.1)

- [ ] Find terms of a geometric sequence (Algebra 2 - BB.2)

- [ ] Write a formula for an arithmetic sequence (Algebra 2 - BB.6)

- [ ] Write a formula for a geometric sequence (Algebra 2 - BB.7)

- [ ] Write a formula for a recursive sequence (Algebra 2 - BB.8)

- [ ] Find the slope of a linear function (Precalculus - A.6)

- [ ] Pascal's triangle (Precalculus - D.16)

- [ ] Binomial Theorem I (Precalculus - D.18)

- [ ] Binomial Theorem II (Precalculus - D.19)

- [ ] Properties of operations on rational and irrational numbers (Precalculus - Q.3)

- [ ] Powers of i (Precalculus - R.6)

- [ ] Find terms of a sequence (Precalculus - W.1)

- [ ] Find a recursive formula (Precalculus - W.4)

- [ ] Find recursive and explicit formulas (Precalculus - W.5)