SD Common Core State Standards Disaggregated Math Template

Domain:	The Complex Number System	**Cluster:**	Perform arithmetic operations with complex numbers	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
N.RN.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.	N.CN.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.	N.CN.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers N.CN.3(+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

Student Friendly Language:
I can determine that a complex number exists when you take the square root of a negative number. I can recognize a complex number of the form a + b*i,* and identify the real and imaginary parts, with a and b real.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Real and imaginary parts of a complex number • All numbers can be written in the form a+b*i*	$i^2 = -1$. Square roots of negative numbers can be found under the complex number system. All numbers, real, imaginary, and/or complex, can be of the form a+b*i.*	Find the a+b*i* form of a complex number Identify the real portion and the imaginary portion of the complex number a+b*i*, with a and b being real numbers.

Key Vocabulary:		
Complex number Real number	Imaginary number Irrational number	Rational number Purely Imaginary
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?		
Complex numbers are used in electrical currents for electrical engineering also fractals and color pixels on a computer screen. Complex numbers can be used to represent vectors.		

SD Common Core State Standards Disaggregated Math Template

Domain:	The Complex Number System	**Cluster:**	Perform arithmetic operations with complex numbers	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
A.APR.1 … add subtract and multiply polynomials. A.SSE.2 Use structure of an expression to identify ways to rewrite it.	N.CN.2 Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	N.CN.3 (+)Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

Student Friendly Language:
I can use the commutative, associative, and distributive properties with operations involving complex numbers. I can add, subtract, and multiply complex numbers. I can use $i^2 = -1$ in the process of simplifying complex numbers after performing operations on them.

Know **(Factual)**	**Understand** **(Conceptual)** **I want students to understand that:**	**Do** **(Procedural, Application, Extended Thinking)**
• $\mathbf{i^2 = -1}$ • Commutative property can be used in conjunction with adding, subtracting and multiplying complex numbers. • Associative property can be used in conjunction with adding, subtracting and multiplying complex numbers. • Distributive property can be used in conjunction with adding, subtracting and multiplying complex numbers.	Complex numbers can be added, subtracted, and multiplied. Complex numbers can be multiplied by a scalar value. The simplified form of a complex number after performing operations on them should be written in the form $a + bi$ where aand b are real numbers and iis the imaginary unit.	Simplify powers of idown to ± 1 or $\pm$ iusing the basic fact that $i^2 = -1$. Add complex numbers using the commutative, associative, and distributive properties. Subtract complex numbers using the commutative, associative, and distributive properties. Multiply complex numbers using the commutative, associative, and distributive properties. Multiply a scalar value by a complex number applying the distributive property and write result in standard complex form.

Key Vocabulary:			
Scalar multiplication Standard Complex number form	Foil method Associative property	Real number Commutative property	Imaginary number Distributive property

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?
Complex numbers are used in electricity/electrical engineering applications involving current, voltage, and impedance.

SD Common Core State Standards Disaggregated Math Template

Domain:	The Complex Number System	**Cluster:**	Use complex numbers in polynomial identities and equations	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
A.REI.4 Solve quadratic equations in one variable. b. 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 quadratic equations by inspection (e.g., for $x2 = 49$), 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. $a \pm bi$ for real numbers a and b. F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. F.IF.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.	N.CN.7 Solve quadratic equations with real coefficients that have complex solutions.	N.CN.8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.*

Student Friendly Language:
I can use the various methods to solve a quadratic equation which has a complex number solutions.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
• Complex number i such that $i^2 = -1$ and every complex number has the form a + bi • Quadratic Formula • Roots of a Quadratic Function • Completing the square	When the discriminant is negative, it means that there are no real roots. There will instead be complex roots involving imaginary numbers. The concept that the solutions to a quadratic equation are the roots(x-intercepts) of the related quadratic function. Quadratic equations with real coefficients can be solved by various methods and result in a pair of complex conjugate roots.	Use the quadratic formula to solve a quadratic equation that has no real roots. Write the imaginary roots as a pair of complex conjugate numbers. Use completing the square to solve a quadratic equation that has no real roots.

Key Vocabulary:			
Quadratic equation	Complex number	Complex conjugate roots	Imaginary solutions
Factoring	Completing the square	Quadratic formula	Solve by inspection

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Quadratic Functions are often used to represent the height of a falling object with respect to time. The roots of the quadratic equation are the times when the falling object would have a height of zero. So the roots are often important points. A quadratic equation without a real root would have to represent a falling object that never hits the ground or is never above ground...So the real world examples of a quadratic function with no real roots doesn’t really happen. BUT, complex numbers are used in electrical engineering and being able to use them has its place. Also, being able to understand the concept of what roots mean in a real situation and being able to realize that no real roots means that the ball never hits the ground is just as important as realizing that a quadratic equation with real roots does hit the ground.

SD Common Core State Standards Disaggregated Math Template

Domain:	The Complex Number System	**Cluster:**	Use complex numbers in polynomial identities and equations.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
N.CN.7 Solve quadratic equations with real coefficients that have complex solutions	N.CN.8(+) Extend polynomial identities to the complex numbers. For example, rewrite $x^2 + 4$ as $(x + 2i)(x – 2i)$.	N.CN.9(+) Know the Fundamental Theorem of Algebra

Student Friendly Language:
I can use complex numbers in polynomial identities and equations I can extend polynomial identities to the complex numbers. I can rewrite a polynomial equation into a complex equations.

Know (Factual)	**Understand (Conceptual) I want students to understand that:**	**Do (Procedural, Application, Extended Thinking)**
• complex number • polynomial identities • polynomial equations • imaginary numbers • complex conjugate	A quadratic function can be written in general form that has zeros as complex numbers.	Write a quadratic function in general form using complex numbers.

Key Vocabulary:
Polynomial Identities Sums of Squares Polynomial Equations
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?
Be able to do projects like “The Mandelbrot Set”

SD Common Core State Standards Disaggregated Math Template

Domain:	The Complex Number System	**Cluster:**	Use complex numbers in polynomial identities and equations.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
N.CN.8 (+) Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x – 2i)$.	N.CN.9 (+) Use complex numbers in polynomial identities and equations. Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.	NA

Student Friendly Language:
I stand and apply the fundamental theorem of algebra to determine the number of complex roots of a polynomial. I can write equations using complex numbers.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
• polynomial function • complex number • complex zeros • conjugate pairs • real zeros • Synthetic Substitution	That a function may have both real or complex zeros. That the number of zeros will be determined by the highest degree of the leading coefficient.	Determine the number of real or complex zeros in a function. Find the number of zeros either real or complex of an equation.

Key Vocabulary:
complex zeros conjugate pairs Synthetic Substitution
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?
You can determine various aspects of a bungee jump. An equation can represent events and you can determine various aspects of the event.

SD Common Core State Standards Disaggregated Math Template

Domain:	Seeing Structure in Expressions	**Cluster:**	Interpret the structure of expressions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.F.2 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*	9-12.A.SSE.1 - Interpret expressions that represent a quantity in terms of its context* A.SSE.1a - Interpret parts of an expression, such as terms, factors, and coefficients. A.SSE.1b- Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)^n as the product of P and a factor not depending on P.	9-12.A.SSE.9-12.4 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. For example, calculate mortgage payments.

Student Friendly Language:
I can interpret what the terms, factors, and/or coefficients are in expressions and formulas.

Know (Factual)	Understand (Conceptual) The Students will understand that:	Do (Procedural, Application, Extended Thinking)
● how to identify factors, terms, coefficients ● what effect a factor, term, or coefficient can have on an expression	Components of expressions and equations have meaning within a function and its real-world context. Expressions and equations can be used to represent physical quantities and relationships.	Recognize and utilize mathematical relationships to explain, interpret, and model.

Key Vocabulary:			
coefficient	term	factor	expression

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

The student could understand how the component parts of the interest formula, for example initial amount, APR, and time, all affect their investing.

The student could understand that y-intercept represents monthly service charge and slope represents charge per text message on a cell phone/data plan.

SD Common Core State Standards Disaggregated Math Template

Domain:	Seeing Structure in Expressions	**Cluster:**	Interpret the structure of expressions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.F.3 Interpret the equation *y = mx + b* as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function A = s^2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1),(2,4) and (3,9), which are not on a straight line.*	A.SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see x^4 – y^4 as (x^2)^2 – (y^2)^2, thus recognizing it as a difference of squares that can be factored as (x^2 – y^2)(x^2 + y^2).	A.SSE.3 - Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression A.SSE.3a- Factor a quadratic expression to reveal the zeros of the function it defines. A.SSE.3b- Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines A.SSE.3c- Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15^t can be rewritten as [1.15^(1/12)]^(12t) ≈ 1.012^(12t) to reveal the approximate equivalent monthly interest rate if the annual rate is 15%

Student Friendly Language:
I can rewrite an expression in many different forms by using algebraic properties without changing its value.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• algebraic properties • factoring methods • equivalent forms of expressions	There are many algebraic properties that can be used to write equivalent forms of an expression.	Apply different algebraic properties to an expression to produce an equivalent form.

Key Vocabulary:								
coefficient	term	factor	expression	equivalent	commutative	associative	distributive	substitution

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

The student could rewrite a formula in order to isolate certain quantities such as the initial amount in an interest problem.

The student could rewrite several expressions in order to put them into the same form. This would enable them to compare similar quantities such baseball batting averages.

SD Common Core State Standards Disaggregated Math Template

Domain:	Seeing Structure in Expressions	**Cluster:**	Write expressions in equivalent forms to solve problems	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.A.SSE.3 - Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression A.SSE.3a- Factor a quadratic expression to reveal the zeros of the function it defines. A.SSE.3b- Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines A.SSE.3c- Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15^t can be rewritten as [1.15^(1/12)]^(12t) ≈ 1.012^(12t) to reveal the approximate equivalent monthly interest rate if the annual rate is 15%	9-12.A.SSE.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. For example, calculate mortgage payments.	N/A

Student Friendly Language:
I can find the first term in a geometric sequence given at least two other terms. I can define a geometric series as a series with a constant ratio between successive terms. I can derive (use) the formula S = ((a (1-rn))/ (1-r)) to solve problems.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• know the parts of a geometric sequence (i.e. common ratio, first term, number of terms	There is a formula for a finite geometric series and it can be used to solve problems.	Derive the formula for a finite geometric series and explain what each component of the formula represents. Apply the formula to calculate the value of a real world finite geometric series

Key Vocabulary:			
Infinite common ratio, r	finite	Recursive Formula (next=now rule) number of terms, N	Explicit Formula (y=rule) A1 first term

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

The student can calculate mortgage payments or any other type payment by recognizing that they represent a finite geometric sum.

Other informations
http://www.khanacademy.org/math/calculus/v/sequences-and-series--part-2
http://fym.la.asu.edu/~tturner/MAT_117_online/SequenceAndSeries/Geometric_Sequences.htm
http://www.wtamu.edu/academic/anns/mps/math/mathlab/col_algebra/col_alg_tut54d_geom.htm

SD Common Core State Standards Disaggregated Math Template

Domain:	Arithmetic with Polynomials and Rational Expressions	**Cluster:**	Perform arithmetic operations on polynomials	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.EE.1 Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	9-12.A.APR.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.	9-12.A.APR.4 Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2+y^2)^2=(x^2-y^2)^2+(2xy)^2$

Student Friendly Language:
I can relate adding, subtracting, and multiplying polynomials to the same operations on integers. I can add, subtract, and multiply polynomials.

Know (Factual)	**Understand (Conceptual) I want students to understand that.**	**Do (Procedural, Application, Extended Thinking)**
• Polynomial definition • Descending order • Ascending order • Degree of polynomial • Analogous • FOIL method	Descending order is useful when completing mathematical operations on polynomials. The order of operations applies to polynomials in the same manner it does to integers. Like terms are necessary to simplify polynomials that have been added and subtracted.	Produce a polynomial of a given degree. Simplify polynomials using order of operations. Determine the need for the commutative, associative, and distributive properties and apply them appropriately. Identify procedural errors in polynomial computation.

Key Vocabulary:				
order of operations	Commutative property	Associative property	Distributive property	Like terms

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

determine unknown related lengths, perimeters, areas, and volumes of geometric shapes. For example, if the length of a rectangle is 4 meters longer than its width, represent its perimeter. This allows for generalizations used in spreadsheet formulas.
Example: Given a cylindrical shape for a footing, how much concrete is needed to fill the footing?

SD Common Core State Standards Disaggregated Math Template

Domain:	Arithmetic with Polynomials and Rational Expressions	**Cluster:**	Understand the relationship between zeros and factors of polynomials	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.A.APR.1 Perform arithmetic operations on polynomials: 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.	9-12.A.APR.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).	

Student Friendly Language:

I can define the remainder theorem.

I can use the remainder theorem to show the relationship between a factor and a zero.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● Synthetic division ● Long division with polynomials ● The relationship between a factor and the remainder	Synthetic division is a shorthand method of dividing a polynomial by a linear binomial using only the coefficients. The remainder of polynomial division by a binomial of form (x-a) is equal to P(a.) When P(a)=0, (x-a) is a factor of P(x.)	Calculate the remainder of dividing a polynomial function in one variable by a linear binomial using synthetic division Understand that a remainder of zero produces a factor of the polynomial. Find the remainder while dividing a polynomial in one variable by a linear binomial, (x-a), by finding P(a)

Key Vocabulary:

polynomial function in one variable binomial function notation synthetic division
factor remainder coefficients

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Finding the factors of polynomials can be used to find the possible solutions to any polynomial function in one variable including, but not limited to, topics such as...

- population models
- using volume of a square pyramid or cylinder to find the possible lengths of its base or radius
- package manufacturing

SD Common Core State Standards Disaggregated Math Template

Domain:	Arithmetic with Polynomials and Rational Expressions	**Cluster:**	Understand the relationship between zeros and factors of polynomials	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented in the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. 9-12.F.IF.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions and show intercepts, maxima, and minima. 9-12.F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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.	9-12.A.APR.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.	9-12.F.IF.9-12.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

Student Friendly Language:

I can use factorization techniques to rewrite a polynomial.

I can identify the zeros of the polynomial from the factored form.

I can construct a rough graph of a polynomial function starting with the zeros.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• The relationship between degree of polynomial and number of zeros • Factorization methods that can be used with polynomials • The relationship between factors and zeros • The representation of zeros on a graph • Extending a graph by finding points other than the zeros	The degree of a polynomial will indicate the maximum number of zeros of the polynomial. The factors of a polynomial can be used to determine the zeros of that polynomial. The zeros of a polynomial are where its graph intercepts the x-axis. Extending a graph by finding points to the left and right of the zeros will give a rough graph of that polynomial.	Determine the degree of a polynomial and the number of possible zeros of that polynomial Simplify polynomials into factored form Identify the zeros of the polynomial using the factors Plot the zeros of the polynomial on a graph Demonstrate understanding by constructing a rough graph of the polynomial using additional points on the graph

Key Vocabulary:

factors zeros polynomial of trinomials factored form
x-intercept degree of a polynomial end behavior
methods of factoring (greatest common factor, difference of squares, difference of cubes, sum of cubes, factoring

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Polynomial functions can be used to graph, explore, and predict trends in areas such as gas consumption, population growth, weights and heights, technology use, and unemployment.

Other topics which can be explored with polynomial functions include:

- Seismic Waves
- Distances
- Velocities
- Interest formulas/financing
- Maximizing/Minimizing volumes
- Forces (physics)

SD Common Core State Standards Disaggregated Math Template

Domain:	Arithmetic with Polynomials and Rational Expressions	**Cluster:**	Use polynomial identities to solve problems	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.A.1.1A (Application) Students are able to write equivalent forms of rational forms algebraic expressions using properties of real numbers.	9-12.A.APR.4 Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 – y^2)^2 +(2xy)^2$ can be used to generate Pythagorean triples.	9.12.A.APR.5(+) Know and apply the Binomial Theorem for the expansion of (x + y)n 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.1 1The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.

Student Friendly Language:

I can simplify algebraic expressions and equations by using known polynomial properties and identities.

I can use factoring and other alternative forms for writing polynomials.

I can prove polynomial identities.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● order of operations ● properties of exponents ● factoring properties ● polynomial identities ● algebraic notation	Polynomials can be decomposed and/or recomposed.. Polynomial identities can be proven. Polynomial identities can generate a specific set of numbers.	The student can use polynomial identities to describe numerical relationships. The student can simplify and prove polynomial identities using properties of algebra The student can demonstrate mathematical reasoning in algebra.

Key Vocabulary:

polynomial identity, numerical relationships, factor, rational polynomials, degree, zeros, roots, properties, decompose, recompose, notation, polynomial expressions and equations

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

An example of using these properties would be to combine two real-life models into one new model, such as a model for money spent at the movies each year.This process is useful when there is more than one model affecting the outcome of another.

Another example would be the manufacturer of radios wants to maximize the company profit by looking at the model that determines money coming in and the model that determines expenses.

The height of an object rising or falling under the influence of gravity.

SD Common Core State Standards Disaggregated Math Template

Domain:	Arithmetic with Polynomials and Rational Expressions	**Cluster:**	Use polynomial identities to solve problems	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
A.APR.9-12.4 Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity (x2 + y2)2 = (x2 – y2)2 +(2xy)2 can be used to generate Pythagorean triples.	9-12.A.APR.5(+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ 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.[1] [1]The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.	9-12.A.APR.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.

Student Friendly Language:

I can apply Pascal's Triangle to the Binomial Theorem to expand an expression (x + y)^n where n is a positive integer.

I can apply the binomial theorem to calculate possible combinations in a situation of choices.

I can apply the binomial theorem to expand (x + y)^n.

I can define the Binomial theorem and compute combinations.

I can explain the connection between Pascal's Triangle and the determination of the coefficients in the expansion of (x+y)^n.

Know (Factual)	**Understand (Conceptual)** **The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Pascal's Triangle ● Binomial Theorem ● Expansions of (x+y) ● Mathematical unduction ● Combinatorial argument	Binomials raised to a power can be expanded using the Binomial Theorem. The binomial theorem can be used to create a probability distribution.	Find the binomial expansion for (x+y)^n by applying Pascal's triangle. Solve applications to find the number of possible ways of a situation Prove the binomial theorem by mathematical induction or a combinatorial argument.

Key Vocabulary:

binomial theorem Pascal's triangle expansion coefficients mathematical induction combinatorial argument exponents probability distribution coefficients

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

In real life, this concept will help find the different combinations that are possible in a given situation.

Example: Given a grid, how many different ways are there from point A which is one corner to point B which is the opposite corner.

Example: When buying a car there are choices for the color, price, accessories, and such. How many different combinations can be considered in your price range?

SD Common Core State Standards Disaggregated Math Template

Domain:	Arithmetic with Polynomials and Rational Expressions	**Cluster:**	Rewrite rational expressions. Linear and quadratic denominators	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.A.1.1A (Application) Students are able to write equivalent forms of rational algebraic expressions using properties of real numbers.	9-12.A.APR.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.	9-12.A.APR.7(+) Rewrite rational expressions. Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication and division by a nonzero expression:add, subtract multiply and divide rational expressions.

Student Friendly Language:
I can rewrite rational expressions using inspection or by long or synthetic division.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• long division of polynomials	Polynomials can be rewritten into another form using division.	Rewrite a rational expression containing a polynomial divided by a monomial. using inspection, long division or synthetic division Demonstrate understanding by rewriting a rational expression containing a polynomial divided by another polynomial using long division.

Key Vocabulary:						
polynomial	long division of polynomials	degree	dividend	divisor	quotient	remainder
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?						
Finding the length of a rectangle when you know the area and the width.						

]SD Common Core State Standards Disaggregated Math Template

Domain:	Arithmetic with Polynomials and Rational Expressions	**Cluster:**	Rewrite rational expressions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.A.APR.6 Rewrite rational expressions.	9-12.A.APR.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.	

Student Friendly Language:
I can add, subtract, multiply, and divide rational expressions. I can determine when a rational expression is undefined.

Know **(Factual)**	**Understand** **(Conceptual)** **The students will understand that:**	**Do** **(Procedural, Application, Extended Thinking)**
● find a common denominator for polynomial expressions ● factor polynomials ● Properties of addition, subtraction, multiplication and division of rational expressions	The procedures for addition, subtraction, multiplication and division of rational numbers are the same for rational expressions.	Explain how to add, subtract, multiply and divide rational expressions. Find the number that will make a rational expression undefined.

Key Vocabulary:
<u>common denominator for rational expression</u> factor reciprocal rational expression
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?
Mixture Problems: Find the amount of acid required to make a solution 60% acid considering a 100ml solution of 30% acid and 70% water. Work Problems Wind speed and current

SD Common Core State Standards Disaggregated Math Template

Domain:	Creating Equations	**Cluster:**	Create equations that describe numbers or relationship	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.EE.7 Solve linear equations in one variable. 8.EE.7a- Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers). 8.EE.7b- Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	9-12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.	9-12.F.BF.1 Write a function that describes a relationship between two quantities. b. Combine standard function types using arithmetic operations. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.

Student Friendly Language:
I can build a one variable equation and find the solution. I can build a one variable inequality and find the solution set.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• algebraic properties of equality • special rules for solving inequalities • linear, quadratic, exponential, and simple rational functions	Functions have related equations or inequalities that can be solved. Real world situations can be represented by an equation or and inequality.	Create an equation and use it to find a solution. Create an inequality and use it to find a solution.

Key Vocabulary:					
equation	inequality	linear	quadratic	rational	exponential

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

The student can write an equation representing the time an object (football) is in the air after being launched and then solve to find various quantities.

The student can create an equation or inequality that represents the amount of money made in a t-shirt fundraiser and determine their break even point.

SD Common Core State Standards Disaggregated Math Template

Domain:	Creating Equations	**Cluster:**	Create equations that describe numbers or relationship	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7EE.4 a & b Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. 8EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed	A.CED.2 Create equations in two or three variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*	N.CN.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.

Student Friendly Language:

I can write equations in two or three variables to represent situations.

I can graph equations on a coordinate plane with appropriate labels and scales.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• graphs and equations of linear functions, quadratic functions, rational functions, and exponential functions • methods of graphing equations • 3 -variable equations and xyz coordinate plane	Relations between two or more variables can be identified to create an appropriate mathematical equation. Equations can be represented graphically on a coordinate plane. Scale and labeling are important when interpreting graphs. The shapes of graphs are related to their equations.	Analyze given information and choose the appropriate mathematical relationship. Create an appropriate equation with two or three variables that represent relationships between quantities. Graph equations in two or three variables on a coordinate plane using appropriate labels and scales on paper/pencil and/or graphing technologies.

Key Vocabulary:

function rational exponential linear quadratic coordinate plane labels scales
For advanced work: half-plane, xyz, three variables, vectors, three dimensions

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

The student could calculate the amount of money accumulated through investment or to be paid back in loan repayment as it relates to interest rate. A(t) = Ao(1+r)^t

The student could compare two cell phones plans each with different monthly charges and usage rates.

The student could determine the height of a projectile based on initial velocity and starting height. h(t) =- 4.9t^2 + v,t + ho

SD Common Core State Standards Disaggregated Math Template

Domain	Algebra: Creating Equations	**Cluster:**	Create equations that describe numbers or relationship	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
CC.8.EE.8 Analyze and solve pairs of simultaneous linear equations. 8.EE.8a- Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. 8.EE.8b- Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations.Solve simple cases by inspection. *For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.* 8.EE.8c- Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*	9-12.A.CED.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. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	9-12.S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

Student Friendly Language:

I can write a system of equations/inequalities based on the constraints that are presented in a given problem.

I can find a solution to a system of equations or solution set to a system of inequalities.

I can explain what a solution means in the context of a problem and determine if that solution is realistic or not.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• methods of solving systems of equations/inequalities • graphical representation given by constraints • meaning of the intersection of viable solutions	In real world situations there are often limiting factors called constraints that need to be taken into consideration. The point(s) or region of intersection represents viable solutions for the problem given.	Create equations/inequalities modelling the constraints presented in the model. Find the point(s) or region of intersection representing viable solutions and explain what those solutions mean in the context of the situation.

Key Vocabulary:

constraints viable region system of equations/inequalities linear programming

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

The student could model a manufacturing situation where they have a limited amount of resources.

The student could build a formula to model time allocation for school work, outside jobs and/or sports participation.

The student could utilize linear programming to find viable solutions to real world applications such as manufacturing scenarios.

SD Common Core State Standards Disaggregated Math Template

Domain:	Algebra: Creating Equations	**Cluster:**	Create equations that describe numbers or relationship	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.EE.7.b Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	9-12.A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.*	9-12.F.LE.4 For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

Student Friendly Language:
I can solve an equation for any variable. I can isolate any variable in a formula.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• algebraic properties • order of operations • inverse operations	Equations in different forms still represent the same equation. Answers may be easier to find once an equation is solved for a certain variable.	Manipulate a formula using algebraic properties in order to isolate a targeted variable.

Key Vocabulary:				
variable	isolate	inverse	equation	formula

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

The student can create equation for use in an Excel spreadsheet.

The student can convert units through the use of appropriate formulas.

The student can use formulas in science and physics to represent relationships between real world quantities and they must be able to use those formulas in a variety of ways.

The student can determine consumer costs through the use of appropriate formulas.

SD Common Core State Standards Disaggregated Math Template

Domain:	Reasoning with Equations and Inequalities	**Cluster:**	Understand solving equations as a process of reasoning and explain the reasoning	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.A.REI.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.	9-12.A.REI.2 Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	9-12.A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Student Friendly Language:

I can determine the domain of a rational function.

I can determine the domain of a radical function.

I can solve rational equations in one variable

I can solve radical equations in one variable.

I can give examples showing how extraneous solutions may arise when solving rational and radical equations.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• How to get a common denominator • How to add fractions • Properties of exponents • Combine like terms • Order of operations • Domain	Extraneous solutions may exist. Algebraic solutions always need to be checked for validity. Taking the square root of a negative number results in a non-real number. Divisibility by zero is undefined.	Solve an equation in radical form Solve an equation in rational form

Key Vocabulary:

radical form (using square roots or roots to the nth power)
rational form (fractions)
<u>extraneous solutions (solutions that appear to be correct when solving using algebra but aren't because of domain restrictions.</u>

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Work Problems can be solved using rational expressions.
Solving for the radius of a circle given the area (solving exponential equations).

Finding light intensity

Distance formula

Examples that give extraneous solutions:

1) $\sqrt{2x+7}-x=2$

SD Common Core State Standards Disaggregated Math Template

Domain:	Reasoning with Equations and Inequalities	**Cluster:**	Represent and solve equations and inequalities graphically	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.EE.8 Analyze and solve pairs of simultaneous linear equations. 9-12.A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.	A.REI.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.*	

Student Friendly Language:
I can approximate or find the solutions to a system. I can explain what it means when the graphs of two functions intersect at a point(s).

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking) (Action)
• Graphs of Functions • Systems of Equations • Function Notation • Solutions of an equation/function • Table of Values	Two functions have equal solutions where their graphs intersect. Two functions have common solutions where their table of values have an equal ordered pair.	Explain why x-coordinate of the intersections of the graphs of two functions is a solution to both functions. Use paper/pencil and technology to produce a table of values explain what x-coordinate of a common ordered pair represents in the context of the problem.

Key Vocabulary:
equivalent function (linear, exponential, absolute value, polynomial, rational, logarithmic solutions ordered pair intercepts line coordinate plane x-axis y-axis intercept form intersection input output
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?
Given two job offers, evaluate and compare the salary options and decide which is better short/long term. What is the break even point for use of E85 as opposed to E10 gasoline, based on cost per mile and mileage of your car? If you have two moving objects, traveling at different speeds, at what point in time will they be in the same location?

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Interpret functions that arise in applications in terms of the context	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.F.4-5 Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. 5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	9-12.F.IF.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. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. Algebra I - linear, exponential, and quadratic Algebra II - emphasize selection of appropriate models	

Student Friendly Language:

I can sketch a graph.

I can correctly label a graph's intercepts and intervals.

I can identify where the function is increasing, decreasing, positive, or negative.

I can identify relative maximums and minimums.

I can identify various symmetries, end behaviors, and periodicity.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• A rough graph of a function can be created if given key features. • A graph's intercepts are locations where it crosses the axes. • A function can have increasing/decreasing (positive/negative intervals) • Relative maxima and minima of a graph indicate the location of crests and troughs. • Symmetries, end behaviors, and periodicity of a function can be interpreted.	Graphs are a visual representation of a function. Intercepts are the points where functions cross the x & y axes. A relative maximum may be the highest point of the graph. A relative minimum may be the lowest point of the graph. There are multiple lines of symmetry and various end behaviors found in functions. Periodic functions repeat themselves. (cookie cutter functions)	Sketch a graph. Label a graph's intercepts and intervals. Interpret where the function is increasing, decreasing, positive, or negative. Interpret relative maximums and minimums. Interpret various symmetries, end behaviors, and periodicity.

Key Vocabulary:

intercept x-intercept y-intercept interval increasing interval decreasing interval relative maximum relative minimum symmetry end-behavior periodicity

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

How does car speed relate to gas mileage? Does an accelerating, idling, or a constant speed of a car create the best gas mileage.

Relationship between position, velocity, and acceleration

Using D = rt to plan a trip

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Interpret functions that arise in applications in terms of the context	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g. where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	9-12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function. Algebra I - linear, exponential, and quadratic Algebra II - emphasize selection of appropriate models	

Student Friendly Language:
I can relate the domain of a function to its graph. I can determine the appropriate domain for a real world situation. I can relate the domain of a function to the relationship it describes.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• The domain is the input or x-coordinate in a function. • The domain can be related to real world situations.	The input values (x-coordinates) are your domain values. Most real world situations can only be modeled with an appropriate domain. The quantitative relationship is the relationship between two numbers or quantities.	Identify the domain from a set of ordered pairs, a mapping diagram, or a graph. Explain whether the domain is appropriate for a specific real world situation and identify the domain.

Key Vocabulary:	
domain	function

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Smoke jumpers are in free fall from the time they jump out of the plane until they open their parachutes. The functon y = -16t^2 + 1600 models a jumper's height y in feet at t seconds for a jump from 1600 ft. How long is the jumper in free fall if the parachute opens at 1000 ft?

To be able to recognize that a function is just an equation and be able to apply the concepts used to solve equations to functions.

To become familiar with function notation used in higher level math classes.

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Interpret functions that arise in applications in terms of the context	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.F.4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x, y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.	9-12.F.IF.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. Algebra I - linear, exponential, and quadratic Algebra II - emphasize selection of appropriate models	

Student Friendly Language:
I can find the slope of a function which is also known as the rate of change, over a specified interval. I can use the graph to interpret the rate of change of the function. I can calculate the rate of change given a table of values over a specified interval. I can define the slope of a line in terms of rate of change.

Know **(Factual)**	**Understand** **(Conceptual)** **The students will understand that:**	**Do** **(Procedural, Application, Extended Thinking)**
• Rate of change can be calculated from a table of values. • Rate of change can be estimated from a graph of a function. • The rate of change can be interpreted from a problem. • Rate of change can be calculated from a mapping.	How to evaluate a function. Real-life situations can be modeled through functions and rate of change. The slope will affect how the function is graphed. Slope is the rate of change of a function over a specified interval. Rate of change can be calculated from a table, graph, mapping, or a function.	Calculate the rate of change given a table of values. Estimate the rate of change given a graph of a function. Interpret the meaning of the rate of change in the context of the problem. Calculate the rate of change using a mapping.

Key Vocabulary:	
Slope	Rate of Change

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

The "pitch" of a roof can be determined by slope. The pitch of a roof could vary from region to region.

Slope and a linear function can be used to predict future events.

Slope is relevant in construction of wheelchair ramps (meeting ADA requirements).

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Analyze functions using different representations	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.F.5 Describe qualitatively the functional relationship between twoquantities by analyzing a graph (e.g., where the function is increasingor decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	9-12.F.IF.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.F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima. (Algebra I) ● 9-12.F.IF.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions (Algebra I and Algebra II) ● 9-12.F.IF.7c- Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. (Algebra II) ● 9-12.F.IF.7d (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. (4th course) ● 9-12.F.IF.7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude (Algebra I and Algebra II) Algebra I - Linear, exponential, quadratic, absolute value, step, piecewise defined Algebra II - Focus on using key features to guide selection of appropriate type of model function. 4th course - Logarithmic and trigonometric functions.	

Student Friendly Language:

I can graph functions and identify the specific features (including zeros, maxima, minima, intercepts, and end behavior).

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● Key features of functions can be used to graph them. ● Characteristics of functions include maxima, minima, increasing, decreasing, end behavior, intercepts, zeros,asymptotes,period, midline, and amplitude. ● Key features of graphs can be used to predict the behavior of functions. ● Different types of functions (linear, quadratic, square root, cube root, piecewise, absolute value, polynomial, exponential, logarithmic, trigonometric) can be used to solve problems.	Leading coefficients and degree determine end behavior. Zeros of the function can be used to help determine factors. Factors can be used to find zeros. Maxima and minima values of a function are used for optimization problems.	Graph functions. Identify and describe key features and characteristics of graphs. Use features of equations and graphs to predict the behavior of a function. Use functions to solve problems.

Key Vocabulary:

maxima minima increasing decreasing linear function quadratic function
square root function cube root function piecewise function step function absolute value function
zeros of functions end behavior rational functions asymptotes exponential function
logarithmic functions trigonometric functions period midline amplitude

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Given a rate, such as cost per minute of a phone plan, graph the function.

Given an interest free loan and constant payments, use a graph to find the amount of time needed to pay off the loan.

Model projectile motion using quadratic functions; use key features of graphs to find maximum height and when the projectile reaches certain heights.

Use functions to solve optimization problems (maximum area/volume, etc).

Calculate compound interest. Apply it to loan or investment situations.

Model tides with trigonometric functions.

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Analyze functions using different representations	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.F.3 Interpret the equation *y = mx + b* as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *y = mx + b* as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line. 2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* 8.F.5 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	9-12.F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. ● 9-12.F.IF.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. ● 9-12.F.IF.8b-Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = 1.02^t$, $y = 0.97^t$, $y = 1.01^{12t}$, $y = 1.2^{t/10}$, and classify them as representing exponential growth and decay Algebra I - Linear, exponential, quadratic, absolute value, step, piecewise defined. Algebra II - Focus on using key features to guide selection of appropriate type of model function.	

Student Friendly Language:

I can change the form of the equation of a quadratic or exponential function.

I can use the changed function to determine information that will help me graph the function.

I can interpret the meaning of parts of the function.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● A variety of methods can be used to find zeros of quadratic functions. ● Completing the square can be used to convert a quadratic function into vertex form. ● The vertex and zeros of a function have real-life meanings. ● There are key features in the graph of a quadratic function. ● Exponential functions can show growth or decay. ● Percent rate of change can be identified from exponential functions.	Completing the square gives a form of quadratic equation that identifies the vertex (maximum and minimum), and axis of symmetry. This form also identifies transformations of the graph of a quadratic equation. Different parts of the quadratic formula provides information about the number of real zeros, the x-value of the vertex, and the x-intercepts of the graph. The zeros of the quadratic function are the x-intercepts of its graph. The base of an exponential function is the percentage rate of change. The sign of the exponent in an exponential function indicates growth or decay.	Factor, complete the square or use the quadratic formula to find zeros of quadratic functions. Complete the square to write a quadratic function in vertex form to find extreme values and identify vertical and horizontal shifts, shrinks, and stretches. Explain the meanings of vertex and zeros in the context of a real-life application. Interpret the symbolic characteristics of a quadratic function as key elements in its graphical representation. Classify exponential functions as growth or decay. Identify percent rate of change in growth and decay functions.

Key Vocabulary:

factoring	completing the square	quadratic formula	vertex form of a quadratic
rate of change	maximum and minimum	axis of symmetry	x and y intercepts
exponential functions	growth model	decay model	

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

The path of a ball in sports can be modeled and analyzed by a quadratic function.

Exponential functions can be modeled by credit card interest rates, savings account interest rates, population, spread of disease, and chemical decay.

Students who are interested will be prepared for upper or advanced-level mathematics and science courses when asked to change the form of an equation into conic form and understand transformations of all functions.

SD Common Core State Standards Disaggregated Math Template

Domain:	Interpreting Functions	**Cluster:**	Analyze functions using different representations	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
C.C.8.F.2 Compare properties of two functions each represented in a different way.	C.C.9-12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions. For Example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum. Algebra I - Linear, exponential, quadratic, absolute value, step, piecewise defined. Algebra II - Focus on using key features to guide selection of appropriate type of model function.	

Student Friendly Language:

I can graph an equation to model real-life situations.

I can identify the slopes and x and/or y intercepts of the two functions represented as an equation and graph.

I can identify, from a graph, the ordered pairs of a function.

I can compare properties of two functions in any form.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• The slope and y-intercept can be determined from linear functions (that may be represented in different ways) • The domain and range can be identified from functions (that may be represented in different ways). • Characteristics about different functions can be described. • It is possible to compare properties between two functions that are represented in different ways.	When graphing a linear equation that has been converted into slope-intercept form the y -intercept is graphed first, then the slope. All functions can be graphed in different ways. Slope is rise over run or change in y over change in x. A function can be presented as an equation, table, graph, mapping, or verbal form. Different representations of functions can be compared.	Identify the slope and x and/or y intercepts of linear equation. Identify domain and range of different functions. Describe the characteristics between linear, quadratic, square root, absolute value, and cubed functions. Compare properties of two functions represented in different forms.

Key Vocabulary:

slope-intercept form	quadratic equation	function	domain	range
coordinate plane	linear equations	tables	minimum	maximum
increase	decrease	properties	mapping	

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

A cell phone company charges $56.35 for their service each month plus $.20 per minute as part of their program package deal. A second cell phone company charges a total flat fee of $95.36 (graph is provided). How many minutes does a person using the first company need to use to pay the same bill for the first company as the second company.

You need to learn this because in everyday life you will be presented material in different forms and you will need to be able to interpret them in any form.

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Build a function that models a relationship between two quantities	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
Functions 8.F Define, evaluate, and compare functions. 1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.Use functions to model relationships between quantities. 4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x*, *y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. 5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	9-12.F.BF.1 Write a function that describes a relationship between two quantities. ● 9-12.F.BF.1 a. Determine an explicit expression, a recursive process, or steps for calculation from a context. (Algebra I) ● 9-12.F.BF.1 b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* (Algebra I and II) ● 9-12.F.BF.1 c. (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* (Fourth year course) Algebra I -Linear, exponential, and quadratic. Algebra II - Include all types of functions studied. Fourth Course -F.BF.1.c only	

Student Friendly Language:
I can create a function that relates two pieces of data. I can interpret a graph. I can determine the pattern in the data. (linear vs quadratics vs exponential) I can perform operations on two or more functions.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● A function can be created to relate two sets of data (often given in table form). ● This created function could be linear, quadratic or exponential. ● The function chosen to relate the data is chosen based on characteristics of the data. ● Operations and compositions can be carried out on two or more functions.	Equations can be created to reasonably model situations. Functions can be added, subtracted, multiplied, and divided.	Interpret a table to write an appropriate function. Apply knowledge of linear, quadratic, and exponential functions to write the equation. Describe why they chose which type of function. Model a relationship between two functions.

Key Vocabulary:		
explicit expression	recursive process	composition of functions

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Population growth/decline is modeled by exponential functions.

Earned income is a linear function that relates time to rate of pay.

Cell phone plans are functions of a base fee and number of minutes used.

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Build new functions from existing functions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.F.4 & 5 Use functions to model relationships between quantities. 4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x*, *y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. 5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	CC.9-12.F.BF.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. Include recognizing even and odd functions from their graphs and algebraic expressions for them. Algebra I - Linear, exponential, quadratic, and absolute value Algebra II - Includes simple radical, rational, and exponential functions; emphasize common effect of each transformation across function types.	

Student Friendly Language:

I can describe what happens to the parent graph of f(x) when substituting values for k (constant), both positive and negative numbers (k can be added, subtracted, or multiplied to the parent function).

I can look at a graph and describe the transformation of a graph based on the k value.

I can try substituting in k values and make observations of what happens to the graph.

I can recognize an even or odd function based on what the graph and equation looks and behaves like.

Know (Factual)	Understand (Conceptual) The student will understand that:	Do (Procedural, Application, Extended Thinking)
• vertical stretch or compression • horizontal stretch or compression • vertical and horizontal shifts • vertical and horizontal reflections • even and odd functions • transformations • appropriate graphing technology	If k is positive, f(x) + k is a vertical translation up. If k is negative, f(x) + k is a vertical translation down. If k is positive, f(x + k) is a horizontal translation to the left since f(x+k) also can be written as f(x- -k). If k is negative, f(x + k) is a horizontal translation to the right since f(x- k). also can be written as f(x + -k) If abs(k) is between 0 and 1 f(kx) is a horizontal compression of the parent graph. If abs(k) is greater than 1 f(kx) is a horizontal stretch. If abs(k) is between 0 and 1, then kf(x) vertical compression of the parent graph. If abs(k) is greater than 1, then kf(x) is a vertical stretch. If k is negative kf(x) is a reflection over the x axis. If k is negative f(kx) is a reflection over the y axis. When given the graph of a function, we can write the function. If given the function, we can graph it.	Graph/identify vertical stretch and/or a compression. Graph/identify a horizontal stretch and/or compression. Graph/identify vertical and/or horizontal shifts. Graph/identify vertical and horizontal reflections. Identify/graph even and odd functions. Describe and explain the transformation of the parent function. Analyze and interpret the graphs of functions.

Key Vocabulary:

Transformations Vertical Translation Horizontal Translation Vertical Stretch
Vertical Compression Horizontal Stretch Horizontal Compression Odd and Even Function
Reflection x-axis y-axis Parent Function Function Shift

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Heart monitors and baby labor pain monitors both compare normal waves to irregular wave patterns. Tuning forks - sound waves, voice analysis are real world usage. All projectile motion like velocity.

SD Common Core State Standards Disaggregated Math Template

Domain:	Building Functions	**Cluster:**	Build new functions from existing functions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
F.BF.9-12.4 Find inverse functions. a. 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. *For example, f(x) =2 x^3 for x > 0 or f(x) = (x+1)/(x–1) for x ≠ 1.* Note: Looks like same standard as current but Algebra I focus is on linear only.	F.BF.9-12.4 Find inverse functions. a. 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. *For example, f(x) =2 x^3 for x > 0 or f(x) = (x+1)/(x–1) for x ≠ 1.* Algebra I - linear only Algebra II - Include simple radical, rational, and exponential functions Note: Looks like same standard as previous year but now include simple radical, rational and exponential functions.	F.BF.9-12.4 Find inverse functions. b. (+) Verify by composition that one function is the inverse of another. c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse. d. (+) Produce an invertible function from a non-invertible function by restricting the domain.

Student Friendly Language:

I can find the inverse of a given function (linear, simple radical, rational and exponential).
- ex. replace f(x) with y, interchange x and y, solve for y, replace y with $f^{-1}(x)$

I can find the inverse of an exponential function using a logarithmic function
- ex. the inverse of $f(x)=b^x$ is $f^{-1}(x)=\log_b x$

I can write the inverse as a function.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Property of Inverse Functions: If *f* and f^{-1} are inverse functions, then f(a)=b iff $f^{-1}(b)=a$ • The inverse of an exponential function can be written using a logarithm.	The inverse of a function can be determined by using the Property of Inverse Functions. An inverse function can be written by using this process: replace f(x) with y, interchange x and y, solve for y, replace y with $f^{-1}(x)$. When using the Property of Inverse Functions on an exponential function, logarithms must be used.	Use the Property of Inverse Functions to write the inverse function of a given function. Write the inverse of an exponential function.

Key Vocabulary:

inverse | inverse relation | inverse function | domain | range

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Basic idea of inverse function: When someone calls you on the phone, he or she looks up your number in a phone book (a function from names to phone numbers). When Caller ID shows who is calling, it has performed the inverse function, finding the name corresponding to the number.

Inverse functions can be used to convert from one measurement unit to another.
ex. If C(x)=5/9(x-32) can be used to convert from Fahrenheit to Celsius. $C^{-1}(x)$ can be used to convert from Celsius to Fahrenheit.

Inverse functions can be used to model and solve real-life problems.
ex. If a function gives the factory sales of digital cameras over a period of years an inverse function can be used to determine the year in which a certain dollar amount worth of digital cameras was sold.

SD Common Core State Standards Disaggregated Math Template

Domain:	Building Functions	**Cluster:**	Construct and compare linear, quadratic, and exponential models and solve problems	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.F.LE.1a, 1b, 1c 9-12.F.LE.2 9-12.F.LE.3 9-12.F.LE.5	9-12.F.LE.4 For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	

Student Friendly Language:

I can change exponential equations into logarithmic form.

I can use properties of logarithms to transform or solve an equation for a given variable.

I can use technology to find logarithms with base 2, 10 or *e*.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• logarithmic form • exponential form • properties of logarithms	Exponential equations can be transformed into logarithmic form. Use technology to evaluate logarithms with base 2, 10, or *e.*	Change an exponential equation into logarithmic form. Apply the properties of logarithms to solve for a given variable. Use technology to find logarithms in base 2, 10, and *e*.

Key Vocabulary:

exponential equation logarithmic equation logarithmic form properties of logarithms
common logarithm(log) natural logarithm(ln) base

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Measure acidity or pH levels and calculate the concentration of hydrogen ions.

Solve problems involving credit card debt (compounding interest).

Loudness of sound according to $L=10\log(I/I_o)$; L is loudness in dB, I is sound intensity and I_o is intensity of softest audible sound

Population growth and decay

Calculation of time in compound interest

SD Common Core State Standards Disaggregated Math Template

Domain:	Trigonometric Functions	**Cluster:**	Extend the domain of trigonometric functions using the unit circle	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.G.C.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.	9-12.F.TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	9-12F.TF.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.

Student Friendly Language:

I can change an angle measurement from radians into degrees or from degrees into radians by using an appropriate conversion factor.

I can calculate an angle measure in a unit circle if I have been given an arc measurement.

I can calculate an arc measurement on a unit circle if I have been given an angle measurement.

I understand that the length of an arc on a unit circle subtended by a central angle and the angle measurement in radians of that angle are exactly the same.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• unit circle • angle measure • $s = r\theta$ (arc length=radius times angle measure in radians) • subtended angle • degree measurements	A unit circle is located on a coordinate plane with the center on the origin and a radius of 1 unit. An arc on a unit circle subtended by an angle is one in which the vertex of the angle is at the origin, and the endpoints of the arc are formed by the intersections of the rays and the unit circle. The length of an arc on a unit circle subtended by a central angle and the angle measurement in radians of that angle are the same.	Convert degree measures into radian measures. Determine the arc length given an angle measure within a unit circle. Determine the angle measure in both degrees and radians given an arc length on a unit circle.

Key Vocabulary:

radian unit circle subtended

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Calculate the distance a pendulum travels or the distance traveled on a bicycle given certain tire sizes using the equation $s = r\theta$.

Place a swing-set in the yard so that it has enough room that the swing will not collide with other items.

SD Common Core State Standards Disaggregated Math Template

Domain:	Trigonometric Functions	**Cluster:**	Extend the domain of trigonometric functions using the unit circle	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.G.C.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.	9-12.F.TF.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	9-12F.TF.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.

Student Friendly Language:

I can change an angle measurement from radians into degrees or from degrees into radians by using an appropriate conversion factor.

I can calculate an angle measure in a unit circle if I have been given an arc measurement.

I can calculate an arc measurement on a unit circle if I have been given an angle measurement.

I understand that the length of an arc on a unit circle subtended by a central angle and the angle measurement in radians of that angle are exactly the same.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• unit circle • angle measure • $s = r\theta$ (arc length=radius times angle measure in radians) • subtended angle • degree measurements	A unit circle is located on a coordinate plane with the center on the origin and a radius of 1 unit. An arc on a unit circle subtended by an angle is one in which the vertex of the angle is at the origin, and the endpoints of the arc are formed by the intersections of the rays and the unit circle. The length of an arc on a unit circle subtended by a central angle and the angle measurement in radians of that angle are the same.	Convert degree measures into radian measures. Determine the arc length given an angle measure within a unit circle. Determine the angle measure in both degrees and radians given an arc length on a unit circle.

Key Vocabulary:

radian unit circle subtended

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Calculate the distance a pendulum travels or the distance traveled on a bicycle given certain tire sizes using the equation $s = r\theta$.

Place a swing-set in the yard so that it has enough room that the swing will not collide with other items.

SD Common Core State Standards Disaggregated Math Template

Domain:	Trigonometric Functions	**Cluster:**	Extend the domain of trigonometric functions using the unit circle	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.G.SRT.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.	9-12.F.TF.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.	

Student Friendly Language:
I can use coterminal angles to evaluate trigonometric functions for all angle measures.

Know (Factual)	**Understand (Conceptual) I want students to understand that:**	**Do (Procedural, Application, Extended Thinking)**
• sine • cosine • tangent • unit circle • initial side • terminal side • radians • degrees • coterminal angle	An angle in standard position has its vertex at the origin, its initial side on the positive x-axis, and opens counterclockwise to the terminal side. The x coordinate of the point formed by the intersection of the terminating side of the central angle and the unit circle is cosine of θand the y coordinate is sine of θ • sine $\theta = \frac{\text{opposite}}{\text{hypotenuse}}$ • cosine $\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$ • tangent $\theta = \frac{\text{opposite}}{\text{adjacent}}$ Trigonometric values of coterminal angles are equal.	Evaluate trigonometric functions for any angle measure using coterminal angles.

Key Vocabulary:				
sine	cosine	tangent	unit circle	initial side
terminal side	radians	degrees	coterminal angle	reference angle

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?
Find the height of a person on a ferris wheel having after the ferris wheel has rotated 1000°.

SD Common Core State Standards Disaggregated Math Template

Domain:	Trigonometric Functions	**Cluster:**	Extend the domain of trigonometric functions using the unit circle	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.G.SRT.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.	9-12.F.TF.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.	

Student Friendly Language:
I can use coterminal angles to evaluate trigonometric functions for all angle measures.

Know (Factual)	**Understand (Conceptual) I want students to understand that:**	**Do (Procedural, Application, Extended Thinking)**
• sine • cosine • tangent • unit circle • initial side • terminal side • radians • degrees • coterminal angle	An angle in standard position has its vertex at the origin, its initial side on the positive x-axis, and opens counterclockwise to the terminal side. The x coordinate of the point formed by the intersection of the terminating side of the central angle and the unit circle is cosine of θand the y coordinate is sine of θ • sine $\theta = \frac{\text{opposite}}{\text{hypotenuse}}$ • cosine $\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$ • tangent $\theta = \frac{\text{opposite}}{\text{adjacent}}$ Trigonometric values of coterminal angles are equal.	Evaluate trigonometric functions for any angle measure using coterminal angles.

Key Vocabulary:				
sine	cosine	tangent	unit circle	initial side
terminal side	radians	degrees	coterminal angle	reference angle

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?
Find the height of a person on a ferris wheel having after the ferris wheel has rotated 1000°.

SD Common Core State Standards Disaggregated Math Template

Domain:	Trigonometric Functions	**Cluster:**	Model periodic phenomena with trigonometric functions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay.	9-12.F.TF.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	

Student Friendly Language:

I can apply transformations to basic sine and cosine functions to represent different amplitudes (size), frequencies (number of times in a period), and midline (height of the middle of the function).

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• sine function • cosine function • transformation • amplitude (magnitude) • period • frequency • phase shift • midline	Frequency involves a horizontal transformation of a trigonometric parent function. Midline involves a vertical translation of a trigonometric parent function. Magnitude involves a scale change of a trigonometric parent function.	Recognize and apply transformations to basic sine and cosine functions to represent different magnitudes (size), frequency (number of times) and midline (height of the middle of the function). Write trigonometric functions that model a graph or a situation with specified frequency (or period), amplitude, and midline.

Key Vocabulary:

sine function	cosine function	transformation	amplitude (magnitude)
frequency	period	phase shift	midline

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Find the exact distance a swing could travel if they knew the length of the chains holding the seat and its distance above the ground.

Analyze movement occurring on a ferris wheel from whatever seat position he or she worked with.

Calculate the distance from the ground of the hands of a clock such as Big Ben for various times of day.

Analyze sound waves from different bands in terms of volume or pitch.

Stretching a sound wave vertically changes the intensity of the tone (loudness). Stretching a sound wave horizontally changes its pitch (octave).

Magnitude can be represented by the spoke length of a bicycle tire, frequency would be the speed, and midline would be the axle height of the tire.

Students will understand that when a sine wave represents sound, doubling the frequency results in a pitch one octave higher.

SD Common Core State Standards Disaggregated Math Template

Domain:	Trigonometric Functions	**Cluster:**	Prove and apply trigonometric identities	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. 9-12.F.TF.3. (+) Use special triangles to determine geometrically the values of sine,cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosines, and tangent for x, π+x, and 2π–x in terms of their values for x, where x is any real number.	9-12.F.TF.8 Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to calculate trigonometric ratios.	9-12.F.TF.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Student Friendly Language:
I can prove that the sum of the squares of corresponding sine and cosines in the unit circle is one. I can use Pythagorean identities to calculate trigonometric ratios.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• identity • sine • cosine • unit circle • Pythagorean identity	The coordinates of the points on the unit circle are (cosine, sine), where x = cosine and y = sine. The sum of the squares of these two values equals the radius of the unit circle (i.e. $\sin^2(\theta) + \cos^2(\theta) = 1$)	Prove that $\sin^2 \Theta + \cos^2 \Theta = 1$. Calculate trigonometric ratios using Pythagorean identities.

Key Vocabulary:			
identity	sine	cosine	unit circle

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?
Students will learn to find different corresponding trigonometric ratios, which can be used to solve for unknowns in problems involving real-life situations.

SD Common Core State Standards Disaggregated Math Template

Domain:	Making Inferences and Justifying Conclusions	**Cluster:**	Understand and evaluate random processes underlying statistical experiments	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.SP.1 and 2 Use random sampling to draw inferences about a population A.CED.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. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	9-12.S.IC.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	

Student Friendly Language:

I can test a theory with understandable outcomes.

I can make statistical inferences.

I know the difference between association and causation.

I understand the difference between a parameter and a statistic.

I can distinguish between discrete variables and continuous random variables.

I can find the mean, median, and mode of probability distributions.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Experimental Study • Observational Study • Survey Study • Continuous Random Variables • Relative Frequency Histogram • Probability distribution	There are advantages and disadvantages of each type of study group: Experimental, Observational, Survey. Different studies are more appropriate for different situations. Bias can affect each type of study. To make appropriate inferences from a set of data infinite or very large populations. Understand the difference between a relative frequency histogram and a probability distribution function.	Determine the type of collection, what is being measured, and the bias that may be associated with a given scenario. Design a study, choose a collection method, and explain potential issues behind the study. Find the probability of a randomly chosen value from a given graph. Determine the median, mean, mode from a given frequency graph.

Key Vocabulary:

inference	population	population parameter	random sample

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Determine the volatility of any set of data based on the collection method.

Determine the mean, median, and mode from any given graph that is used in statistics.

Since it is impractical to survey every American for a political poll, we need to be able to design more efficient sampling methods and be able to make inferences from the data collected from them.

SD Common Core State Standards Disaggregated Math Template

Domain:	Making Inferences and Justifying Conclusions	**Cluster:**	Understand and evaluate random processes underlying statistical experiments	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.SP.7. Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.	9-12.S.IC.2 Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?	

Student Friendly Language:
I can use the experimental probability of an outcome to evaluate a specified model.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● Experimental Probability ● Theoretical Probability ● Simulation	The experimental probability should be close to the theoretical probability; if it is not, there could be a flaw in the data-generating process or there may have been too few trials in the simulation. If the experimental probability is significantly different from an existing model, there may be evidence to overturn the existing model.	Compare experimental probability to the theoretical probability to determine if the data-generating process was likely accurate or flawed. Create accurate data-generating processes. Evaluate the validity of existing models by using data-generating processes.

Key Vocabulary:				
fair	simulation	outcome	probability	trial

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Determine if an experiment is accurate by comparing the experimental outcomes to the theoretical outcomes.

A medical organization claims that a surgery has a 95% success rate. A researcher studies 200 patients who underwent the surgery and finds that 172 of those patients experienced successful results. Is there enough evidence to overturn the organization’s claims?

SD Common Core State Standards Disaggregated Math Template

Domain:	Making Inferences and Justifying Conclusions	**Cluster:**	Make inferences and justify conclusions from sample surveys, experiments and observational studies	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
S.ID.9-12.1-8	9-12.S.IC.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	S.MD.9-12.1-4

Student Friendly Language:

I know the usefulness of sample surveys, experiments, and observational studies.

I can explain the similarities and differences between sample surveys, experiments, and observational studies.

I can explain why the conditions under which data are collected must be random.

I can explain how randomization is important to be able to draw valid statistical conclusions from my data.

Know (Factual)	Understand (Conceptual) Students will understand that:	Do (Procedural, Application, Extended Thinking)
● A well-designed experiment must have random assignment of treatments to subjects a sufficient number of subjects, and a comparison or control group. ● The three types of statistical studies are: sample surveys, experiments, and observational studies. ● Sampling Methods: Random, Stratified Random, Convenience, Cluster, Systematic ● Experimental Procedure: Know the steps	Randomization is important in gathering representative data. Certain methods should be used to collect a random sample and reduce potential bias. Bias affects results. It is important to be able to recognize and diagnose bias and be able to minimize bias. Certain procedures should be followed to successfully carry out an experiment.	Explain why a sample survey, an experiment, or an observational study is most appropriate for a situation. Distinguish between sample surveys, experiments, and observational studies. Recognize and explain whether a sample survey, experiment, or observational study is random or if it has bias.

Key Vocabulary:

sample survey experiment observational study randomization

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

This standard has a lot of real-world relevance and application. The media and workplace are filled with surveys, experiments, and studies. It is very important for a student to be able to perform on one of these three statistical studies to come up with information about their related field. Also, it is important for them to be able to look critically at results that are presented to them and decide if those results are valid and reliable. They cannot do that if they do not understand the process in which the data was collected. This standard is applicable when they read a newspaper or magazine, vote in an election, look at trends in their work, etc... The possibilities of having to use this are many.

SD Common Core State Standards Disaggregated Math Template

Domain:	Making Inferences and Justifying Conclusions	**Cluster:**	Make inferences and justify conclusions from sample surveys, experiments and observational studies	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
S.ID.9-12.1-8	9-12.S.IC.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.	S.MD.9-12.1-4

Student Friendly Language:

I can use data from a sample survey to estimate a mean or a proportion for the entire population.

I can set up and use a proportion to translate sample data into population estimates.

I can determine a margin of error for data estimates about a population that are based on a sample survey.

Know (Factual)	Understand (Conceptual) Students will understand that:	Do (Procedural, Application, Extended Thinking)
● Margin of Sampling Error Formula ● Sampling Methods: Random, Stratified Random, Convenience, Cluster, Systematic ● Confidence intervals	A sample survey gives us estimates of population mean or proportion. These may differ from the true population mean or proportion. Calculating and reporting the margin of error is important in showing how precise the results are likely to be. The estimates of population means and proportions and the margin of error can be used to establish confidence intervals.	Estimate a population mean or proportion using data from a sample survey. Determine the margins of error for population estimates. Determine confidence intervals for a sample survey.

Key Vocabulary:

margin of error confidence interval

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

This standard has a lot of real-world relevance and application. The media and workplace are filled with surveys. The ability to conduct a survey and use that data to draw valid conclusions about a population are very important. Two of those conclusions that are important are a population mean and a margin of error. Not only does a student need to be able to create a sample and draw conclusions, but also think critically about data that is created by others and presented to them.

Use data collected from a telephone survey to calculate the proportion of a the population that supports a given political candidate and report these results with the margin of error.

SD Common Core State Standards Disaggregated Math Template

Domain:	Making Inferences and Justifying Conclusions	**Cluster:**	Make inferences and justify conclusions from sample surveys, experiments and observational studies	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
S.IC.9-12.3 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	9-12.S.IC.5 Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	N/A

Student Friendly Language:
I can use a randomization test to decide if an experiment provides statistically significant evidence that one treatment is more effective than another.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• randomized experiment • statistically significant • Type I and Type II errors	Data collected from randomized experiments can be used to compare two or more treatments. Data can be used to suggest if the difference in results of a study are statistically significant or if the differences could be attributed to chance alone. Even statistical data carefully gathered does not guarantee representative results. To conclude that two treatments cause a difference when in fact they do not is called a Type I error. Failing to conclude that the treatments make a difference when in fact they do is a Type II error.	Use a randomization test to decide if an experiment provides statistically significant (outer 5%) evidence that one treatment is more effective than another. Compare two treatments, using data from a randomized experiment. Recognize when a Type I or Type II error may be occurring.

Key Vocabulary:				
randomized experiment	treatment	statistically significant	Type I error	Type II error

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Determine if a particular drug is more effective against acne than nontreatment or test the differences between two treatments.

Inference and prediction skills enable informed decision-making based on data such as whether to stop using a product based on safety concerns, or whether a political poll is pointing to a trend.

Other Information or Resources:

http://www.wmich.edu/cpmp/CPMP-Tools/
The website above has a simulation tool that can be used to conduct a randomization test.
1) Install
2) Go to Course 3, then Statistics, then Randomization Distribution (this site gives examples that are in the text below).

http://www.isd2184.net/~althofft/Math/Book/C3/unit01_c3.pdf
The website above is a Core Textbook that gives examples and explains the randomization distribution.
1) Go to Course 3
Unit 1:Reasoning and Proof
Lesson 4: Statistical Reasoning,
Investigation 2: By chance or from Cause?

SD Common Core State Standards Disaggregated Math Template

Domain:	Making Inferences and Justifying Conclusions	**Cluster:**	Make inferences and justify conclusions from sample surveys, experiments and observational studies	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
S.IC.9-12.5	9-12.S.IC.6 Evaluate reports based on data.	N/A

Student Friendly Language:

I can define the characteristics of experimental design (control, randomization, and replication).

I can evaluate the experimental study design, how the data was gathered, what analysis (numerical or graphical) was used (ex: use of randomization, control, replication).

I can draw conclusions based on graphical and numerical summaries.

Know (Factual)	Understand (Conceptual) I want students to understand:	Do (Procedural, Application, Extended Thinking)
• characteristics of experimental design	Data is used to evaluate reports.	Evaluate reports based on data.

Key Vocabulary:

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

Inference and prediction skills enable informed decision-making based on data such as whether to stop using a product based on safety concerns, or whether a political poll is pointing to a trend.

Suppose the summary statistics for the number of inches of rainfall in Northampton, MA for the past 117 years, beginning in 1877, are given below.

N	Mean	Median	Minimum	Maximum	Q1	Q3
117	42.8	41.4	22.5	68.0	37.3	48.4

a) Sketch a boxplot for these data and describe the key features of the data distribution.
b) The news media reported that in a particular year, there were only 38 inches of rainfall. Is it appropriate for the news media to use the word only in the statement? In other words, is 38 inches an unusually small amount of rainfall for Northampton? Explain your answer.

SD Common Core State Standards Disaggregated Math Template

Domain:	Interpreting Categorical and Quantitative Data	**Cluster:**	Summarize, represent, and interpret data on a single count or measurement variable	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
S.ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).*	S.ID.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.	S.ID.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.*

Student Friendly Language:

I can describe the characteristics of a normal distribution.

I can use a calculator, spreadsheet, and table to estimate areas under the normal curve.

I can use the mean and standard deviation of a data set to fit it to a normal distribution.

I can use normal distribution to estimate population percentages.

I can recognize that there are data sets for which such a procedure is not appropriate.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
• 68% of data lies within one standard deviation of the mean, 95% of data lies within two standard deviations from the mean and 99.7% of data lies within three standard deviations from the mean	How mean and standard deviation work. How to calculate population percentages from a normal distribution. Not all data sets fit a normal distribution.	Use the mean and standard deviation of a data set to fit it to a normal distribution. Use mean and standard deviation to estimate population estimates. Use a calculator, spreadsheet, or table to estimate areas under a normal curve

Key Vocabulary:

Mean	Standard Deviation	Normal Distribution	Empirical Rule

Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Given three sets of test scores, determine which of them can be fit to a normal distribution. For the set(s) of scores that can be fit to a normal distribution, determine the mean and standard deviation to figure out the range of scores for each letter grade.

SD Common Core State Standards Disaggregated Math Template

Domain:	Using Probability to Make Decisions	**Cluster:**	Use probability to evaluate outcomes of decisions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.SP.1. Understand that random sampling tends to produce representative samples and support valid inferences. 7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of an event occurring.	9-12.S.MD.6 (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator)	

Student Friendly Language:
I can use probability to make fair decisions.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• what criteria makes a fair decision • probability can be used to ensure a fair decision	A fair decision occurs when each event in the sample space is equally likely (same probability) to be chosen. A variety of devices can be used to make fair decisions. (examples: coins, number cubes, spinner, random number tables, random number generators)	Determine if decisions are fair. Use probability to make fair decisions.

Key Vocabulary:			
fair decision	equally likely	outcome	probability
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?			
An elderly woman wishes to give a family heirloom to one of her 12 great grandchildren. Determine a method that she can use to fairly decide which great grandchild will inherit the heirloom. A polling organization wants to collect a representative sample from a large population. How can the organization fairly choose 200 people to survey?			

SD Common Core State Standards Disaggregated Math Template

Domain:	Using Probability to Make Decisions	**Cluster:**	Use probability to evaluate outcomes of decisions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of an event occurring.	9-12.S.MD.7 (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	

Student Friendly Language:
I can use probability concepts to analyze decisions and strategies.

Know (Factual)	**Understand (Conceptual)** **The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• probability concepts	Probability concepts can be used to make decisions in a variety of contexts.	Use probability concepts to analyze decisions and strategies.

Key Vocabulary:
probability
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?
Determine if a pinch hitter should be used in various circumstances in a baseball game. Analyze various coaching decisions in a football game (examples: whether to punt, attempt a field goal, or go for it on fourth down). Analyze the choice of treatment, or nontreatment, for a patient.