SOUTH DAKOTA 6–8 MATHEMATICS STANDARDS PROGRESSION

GRADE COLOR KEY	6	7	8

NUMBER CONCEPTS AND COMPUTATIONS

Rational Numbers	**6.NC.1 Understand a ratio as a comparison of two quantities.**	**6.NC.2 Classify numbers (integers, fractions, decimals) as rational numbers.**	**6.NC.3 Explain positive and negative integers as being opposite (inverse) values or directions from zero. Also, explain zero as its own opposite.**	**6.NC.4 Understand the meaning of zero in a real-world context.**	**6.NC.5 Understand the absolute value of rational numbers to be its distance from zero on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation.**	**6.NC.6 Determine the absolute value of a rational number by finding its distance from zero on a number line in real-world situations; recognize that the opposite of the opposite of a number is the number itself.**	**6.NC.7 Write, interpret, and explain statements of order for rational numbers in real-world contexts.**	**7.NC.1 Model and describe additive inverse in real-world situations to show opposite quantities combine to make zero (positive or negative).**	**7.NC.2 Demonstrate in real-world contexts the distance between two rational numbers on the number line as the absolute value of their differences.**	**7.NC.3 Convert a rational number in fraction form to decimal form and recognize that the decimal form of a rational number terminates in zeros or eventually repeats (using bar notation).**	**7.NC.4 Understand that integers can be divided, provided the divisor is not zero.**

Rational Number Operations	**6.NC.8 Use visual models (e.g., area models, number lines) to explore and explain why dividing by a fraction is equivalent to multiplying by its reciprocal.**	**6.NC.9 Use visual models (e.g., area models, number lines) to explain, justify, and apply the process of dividing fractions by fractions in real-world contexts.**	**6.NC.10 Solve word problems involving division of fractions by fractions.**	**6.NC.11 Compare rational numbers, using inequalities (<, >, ≤, ≥, ≠) and order on a number line.**	**7.NC.5 Add and subtract rational numbers using horizontal or vertical number lines and real-world contexts.**	**7.NC.6 Solve multi-step problems with rational numbers (whole numbers, fractions, and decimals) and justify the steps taken.**	**7.NC.7 Multiply and divide rational numbers (integers, fractions, decimals etc.) in real-world and mathematical problems.**

NUMBER CONCEPTS AND COMPUTATIONS *continued*

Rational Number Operations (continued)	**8.NC.5 Explain how the properties of integer exponents work by using patterns and reasoning to generate and justify equivalent expressions.**	**8.NC.6 Understand the root index to be the number placed above the radical symbol indicating which root to find and recognize that if the root index is not specified, it is assumed to be 2.**	**8.NC.7 Understand a square root of a number to be the number that when multiplied by itself produces the original number.**	**8.NC.8 Understand the cube root of a number to be a number that when cubed produces the original number.**	**8.NC.9 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares (up to 100) and cube roots of small perfect cubes (up to 125).**	**8.NC.10 Write numbers in scientific notation using positive and negative exponents.**	**8.NC.11 Perform operations (add, subtract, multiply, divide) with numbers in scientific notation.**
Common Factors and Multiples	**6.NC.12 Find the greatest common factor of two whole numbers less than or equal to 100.**	**6.NC.13 Find the least common multiple of two whole numbers less than or equal to 12.**	**6.NC.14 Use the distributive property to rewrite the sum of two whole numbers 1-100 using its greatest common factor.**				
Mathematical Fluency	**6.NC.15 Fluently divide multi-digit numbers using various strategies, including but not limited to the standard algorithm.**	**6.NC.16 Fluently add, subtract, multiply, and divide multi-digit decimals and fractions using various strategies, including but not limited to the standard algorithm.**					
Rational and Irrational Numbers	**8.NC.1 Understand that a real number is any number that can be represented on a number line.**	**8.NC.2 Classify numbers as rational or irrational and explain how both sets together form the set of real numbers.**	**8.NC.3 Understand an irrational number to be a non-terminating, non-repeating decimal that cannot be expressed as a fraction of two integers (rational number).**	**8.NC.4 Compare the value of irrational numbers and locate them on a number line by finding the rational approximations.**			

PROPORTIONAL RELATIONSHIPS							
Ratio and Rates	**6.PR.1 Write ratios, rates, and unit rates. Determine the units of a unit rate.**	**6.PR.2 Use ratio and rate reasoning to solve real-world and mathematical problems including making ratio tables, solving unit rate problems, and using percentages.**	**6.PR.3 Solve unit rate problems including those involving unit pricing and constant speed.**	**6.PR.4 Find a percent of a quantity as a rate per 100.**	**7.PR.1 Calculate unit rates in real-world contexts that include complex fractions.**	**7.PR.2 Determine the unit rate (constant of proportionality *y= kx*) from tables, graphs, equations, diagrams, or verbal descriptions of proportional relationships.**	**7.PR.3 Solve multi-step ratio and percent problems using proportional reasoning.**
Constant of Proportionality	**7.PR.4 Determine whether two quantities are in a proportional relationship, by determining if each have a constant rate of change that starts at (0,0), using tables, graphs, equations, diagrams, and verbal descriptions.**	**7.PR.5 Explain what a point (*x, y*) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0,0) and (1, *r*) where r is the unit rate.**					

ALGEBRA

Expressions	**6.A.1 Write and evaluate numerical expressions involving whole-number exponents, including those with parentheses.**	**6.A.2 Translate verbal descriptions into algebraic expressions and evaluate them for given values.**	**6.A.3 Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient, variable, constant) and view one or more parts of an expression as a single entity.**	**6.A.4 Evaluate expressions at specific values of their variables, including expressions with whole number exponents and those from formulas in real-world problems. Explain how the structure of an expression affects its value by justifying each step using the order of operations and properties of operations.**	**6.A.5 Apply properties of operations (distributive, commutative, associative) to generate equivalent expressions.**	**7.A.1 Write and solve equations ($y = kx$ or $y = mx+b$) to represent relationships between quantities.**	**7.A.2 Add, subtract, factor, and expand linear expressions with rational coefficients using multiple grouping symbols.**	

Equations and Inequalities	**6.A.6 Use substitution to determine if a given value in a specified set makes an equation or inequality true. Include the following inequality symbols: $<$, $>$, $\leq$, $\geq$, $\neq$.**	**6.A.7 Write and solve one-step equations in real-world and mathematical problems, involving positive rational numbers and zero.**	**6.A.8 Write, solve, and graph one-step inequalities in real-world and mathematical problems, involving positive rational numbers and zero.**	**6.A.9 Understand an equation with two variables as a statement expressing a relationship between two quantities, and recognize that this relationship can often be represented as a function, where one variable depends on the other.**	**6.A.10 Analyze the relationship between the dependent and independent variables in an equation using tables and graphs, relating these to the equation.**	**7.A.3 Write and solve two-step equations in real-world and mathematical problems in the form of $px + q = r$ and $p(x + q) = r$ where p, q, and r are specific rational numbers.**	**7.A.4 Write, solve, and graph two-step inequalities in real-world and mathematical problems in the forms of $px + q > r$, $px + q \geq r$, $px + q < r$, and $px + q \leq r$, where p, q, and r are specific rational numbers.**	**8.A.1 Identify linear equations in one variable with one solution, infinitely many solutions, or no solution.**	**8.A.2 Solve linear equations with rational number coefficients using the distributive property and combining like terms.**	**8.A.3 Analyze and solve one-variable linear inequalities with rational coefficients.**

ALGEBRA

Relationships between Quantities	**7.A.5 Use tables, graphs, and equations to distinguish between proportional and non-proportional relationships.**				
System of Equations	**8.A.4 Understand a system of linear equations to be a set of two or more equations.**	**8.A.5 Determine whether an ordered pair is a solution to a system of two linear equations by substituting the values into both equations and explaining why the pair satisfies both.**	**8.A.6 Analyze a system of two linear equations to determine whether it has one solution, infinitely many solutions, or no solution, and explain what each case means in terms of the graphs or equations.**	**8.A.7 Analyze and solve systems of linear equations algebraically and estimate solutions by graphing the equation.**	**8.A.8 Solve real-world and mathematical problems involving leading to two linear equations in one and/or two variables.**

GEOMETRY

Area, Volume, and Surface Area	**6.G.1 Find the area of triangles, special quadrilaterals, and polygons by composing or decomposing to solve real-world problems.**	**6.G.2 Find the volume of right rectangular prisms with fractional edge lengths by packing and relate it to multiplication.**	**6.G.3 Draw polygons in the coordinate plane when given coordinates for the vertices.**	**6.G.4 Use coordinates to calculate vertical and horizontal distances between points with the same *x*-coordinate or the same *y*-coordinate to solve real-world and mathematical problems.**	**6.G.5 Construct nets of a rectangular prism, rectangular pyramid, triangular prism, and triangular pyramid, using the nets to find the surface area of these prisms and pyramids.**	**7.G.1 Identify, describe, and draw elements of circles, including center, radius, and diameter.**	**7.G.2 Use the constant ratio *pi* ($\pi = C/d$) to calculate the circumference and area of a circle.**	**7.G.3 Use area ($A = \pi r^2$) and circumference ($C = 2\pi r$) formulas of a circle to solve real-world and mathematical problems.**	**7.G.4 Solve real-world and mathematical problems involving area, volume and surface area of two and three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.**	**8.G.1 Explain the formulas for the volumes of cones, cylinders, and spheres and apply them to solve real-world and mathematical problems.**
Coordinate Plane System	**6.G.6 Find and graph pairs of rational numbers in all four quadrants of the coordinate plane in real- world and mathematical problems.**	**6.G.7 Understand that signs of a coordinate pair indicate locations in a quadrant of the coordinate plane, opposite signs indicate reflections across one or both axes.**								
Cross Sections	**7.G.5 Describe the two-dimensional figure (cross section) that results from slicing a three-dimensional figure including right rectangular prisms, triangular prisms, pyramids and cylinders.**									
Triangle and Angles	**7.G.6 Draw geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.**	**7.G.7 Solve multi-step problems involving supplementary, complementary, vertical, and adjacent angles to include solving for an unknown angle in a figure.**								

GEOMETRY continued

Triangles and Angles	**8.G.2 Understand properties of interior and exterior angles in triangles (triangle sum theorem, exterior angle theorem).**	**8.G.3 Understand and explain the relationships between angles when parallel lines are intersected by a transversal.**					
Pythagorean Theorem	**8.G.4 Identify, describe, and draw elements of triangles including base, height, leg, and hypotenuse.**	**8.G.5 Explain the Pythagorean theorem and apply it to find unknown side lengths in right triangles.**	**8.G.6 Explain the converse of the Pythagorean theorem and apply it to determine if a triangle is a right triangle.**	**8.G.7 Apply the Pythagorean theorem to find the distance between two points in a coordinate system.**			
Transformation, Similarity, and Congruency	**8.G.8 Understand congruent figures to be geometric objects that have exactly the same size and shape.**	**8.G.9 Understand similar figures to be geometric objects that have the same shape (congruent angles), but different sizes (proportional) sizes.**	**8.G.10 Understand a rigid transformation to be a change in location or orientation that generates a congruent shape by preserving distances between vertices.**	**8.G.11 Identify, draw, and describe the three types of rigid transformations on two-dimensional figures: rotations, reflections, and translations.**	**8.G.12 Identify, draw, and describe mathematical dilations on, two-dimensional figures, as non-rigid transformations that generate a similar shape.**	**8.G.13 Describe a sequence of rigid transformations that moves and aligns one congruent shape onto another.**	**8.G.14 Understand and explain the angle-angle criterion for determining the similarity of triangles.**

MEASUREMENT	
Conversions	**6.M.1 Use ratio reasoning to convert measurement units within the U.S. Customary and metric measuring systems.**
Scale	**7.M.1 Calculate the scale factor, compute the actual lengths from the scale in a drawing, and reproduce a scale drawing using another scale.**

STATISTICS AND PROBABILITY

Statistical and Nonstatistical	**6.SP.1 Understand the four components of the statistical process (question formulation, data collection, data analysis, interpretation).**	**6.SP.2 Recognize that data sets collected to answer a statistical question can be analyzed by their distributions.**		
Numerical Data	**6.SP.3 Represent numerical data on a number line, histogram, and box plot.**	**6.SP.4 Interpret a box plot to answer statistical questions about a data set.**		
Measures of Center	**6.SP.5 Distinguish between a measure of center (mean, medium, and mode) and measure of variation (range and/or mean absolute deviation).**	**6.SP.6 Calculate and interpret any measure of center (mean, median, and mode) of a numerical data set.**	**6.SP.7 Determine which measure of center (mean or median) is more appropriate to describe the center of data; justify the choice.**	
Measures of Variation	**6.SP.8 Compare and interpret range and interquartile range (IQR) to describe how data varies in a distribution.**	**6.SP.9 Calculate and interpret the measure of variation (range, interquartile range (IQR), and/or mean absolute deviation) of a numerical data set.**		
Sampling and Population	**7.SP.1 Understand sampling to be a selection of a smaller group (sample) from a larger group (population).**	**7.SP.2 Compare random and convenience sampling to determine if a sample is representative of a population.**	**7.SP.3 Draw conclusions, such as mean, median, mode, and range of data, about a larger population using data from a representative sample.**	**7.SP.4 Understand a sample space to be the set of all possible outcomes for a situation or experiment.**

STATISTICS AND PROBABILITY continued

Probability	**7.SP.5 Understand probability as the likelihood or chance of an event occurring.**	**7.SP.6 Recognize that probabilities in a simple experiment can be qualitative descriptors of likelihood: impossible (0), unlikely, neither likely nor unlikely, likely, or certain (1).**	**7.SP.7 Calculate the probability for a single event by dividing the number of favorable outcomes by the number of total outcomes.**	**7.SP.8 Determine experimental probabilities in simple experiments and represent as fractions, decimals, and percents.**	**7.SP.9 Use theoretical probability of an event in a simple experiment to predict the number of times that an event will occur for a large number of experiments.**	**7.SP.10 Calculate the probability for a compound event using organized lists, tables, tree diagrams, and a simulation.**

Bivariate Data	**8.SP.1 Construct and interpret scatter plots using bivariate data; determine if the data displays a linear or nonlinear pattern and describe the patterns as clustering, outliers, positive, negative, or no association.**	**8.SP.2 Construct a line of fit to approximately fit data displaying a linear association when presented in scatter plot.**	**8.SP.3 Construct and interpret a relative frequency table.**

RELATIONSHIPS AND FUNCTIONS

Proportional and Linear Relationships	**8.RF.1 Graph proportional relationships, interpreting the rate of change as the slope of the graph.**	**8.RF.2 Construct a function to model a linear relationship between two quantities.**	**8.RF.3 Compare two different proportional relationships represented in different ways.**	**8.RF.4 Explain how the slope m of a line is the same between any two points on a line. Types of slope include: positive, negative, zero (horizontal), and undefined (vertical).**						
Functions	**8.RF.5 Define a function as a rule where each input has exactly one output.**	**8.RF.6 Understand the domain as the set of inputs allowed by the function.**	**8.RF.7 Understand the range as the set of outputs produced by the function.**	**8.RF.8 Determine whether a relationship is a function given a table, graph, equation, or verbal description.**	**8.RF.9 Compare properties of two functions represented in different ways including tables, graphs, equations, and verbal descriptions.**	**8.RF.10 Determine whether a relationship is linear or nonlinear given a table, graph, equation, or verbal description.**	**8.RF.11 Understand a linear function to be a relationship between two variables with a constant rate of change whose graph is a straight line on the coordinate plane and to have the equation *y= mx + b* , give examples of functions that are not linear.**	**8.RF.12 Explain how the rate of change and y-intercept describe the relationship between two quantities, using multiple representations to justify interpretations.**	**8.RF.13 Explain how the rate of change (slope) and y-intercept (initial value) describe the relationship between two quantities, using multiple representations to justify interpretations.**	**8.RF.14 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear).**