SD Common Core State Standards Disaggregated Math Template

Domain:	Number Sense	**Cluster:**	Know that there are numbers that are not rational, and approximate them by rational numbers	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.NS.2d Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.	8.NS.1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.	9-12.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.

Student Friendly Language:
I can look at the decimal form of any real number and identify it as rational or irrational. I can understand that every real number can be written as a decimal. I can convert a repeating decimal into a fraction.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Rational numbers • Irrational numbers • Real Numbers • Decimal expansion • Terminating decimals • Repeating decimals	All real numbers can be written in decimal form. There are rational and irrational numbers. Rational numbers in decimal form repeat or terminate. Irrational numbers in decimal form do not repeat or terminate.	Write any real number in decimal form. Convert terminating or repeating decimals to fractions. Classify any real number as rational or irrational.

Key Vocabulary:				
Rational numbers	rrational numbers	Real numbers	Decimal expansion	fractions
Terminating decimals	Repeating decimals	Non-terminating	Non-repeating decimals	Square roots

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"?
Mary has a batting average of .54545454..... What is this as a fraction?

SD Common Core State Standards Disaggregated Math Template

Domain:	Number System	**Cluster:**	Know that there are numbers that are not rational, and approximate them by rational numbers	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.NS 2.d Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in zeros or eventually repeats.	8.NS.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). For example, by truncating the decimal expansion of √2 (square root of 2), show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.	9-12.N-RN 3 Explain why the sum or product of rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

Student Friendly Language:

I can approximate the size of an irrational number by changing it to its decimal form.
I can use the approximated decimal form of an irrational number to place it on a number line.
I can estimate the value of an expression that has an irrational number.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Approximating irrational numbers • Truncating	Irrational numbers fall between two rational numbers. Irrational numbers can be placed on a number line. Irrational numbers and expressions have a never-ending value that can be truncated. Irrational numbers can represent real quantities such as π and non-perfect square roots.	Approximate irrational numbers to compare and order them. Graph approximated irrational numbers on a number line. Estimate the value of an expression that has an irrational number.

Key Vocabulary:

Rational numbers	Irrational numbers	Truncate	Approximate	Square root
Perfect squares	Expression	Number line	π	

Relevance and Applications: How might the grade level expectation be applied at home, on the job or n 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, we encounter situations in which our calculations result in irrational numbers. In order to deal with these situations, we round to an appropriate number of decimal places for the situation. Common applications are in the fields of carpentry, engineering, and surveying. It is important to take into account round-off error when calculating very large or very precise measurements. An example of the possibility of substantial round-off error is in calculating the circumference of the earth.

For example, by truncating the decimal expansion of √2 (square root of 2), show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

It is Christmas time and I want to decorate my farm yard with Christmas lights. I will be putting lights on all the buildings and grain bins in the yard. I need to figure out how long the string of lights needs to be to go all the way around my grain bin. (You will be finding the circumference of a circle which uses π.)

If your doorway is 7 feet by 3 feet, will a table that is 8 feet in diameter fit through it? (Pythagorean Theorem)

If you have a circular garden and you need to calculate how much fertilizer you need, you would need to use π to calculate the area.

Calculate the volume of a snow cone cup.

How much wrapping paper would you need to wrap a gift in the shape of a cylinder?

Sue has a square garden in her backyard with an area of 210 square feet. Estimate a side of the garden to the nearest tenth of a foot.

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressions and Equations	**Cluster:**	Work with radicals and integer exponents	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.NS.2 Apply and extend previous understanding of multiplication and division and of fractions to multiply and divide rational numbers.	8.EE.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 3^2 × 3^(–5) = 3^(–3) = 1/(3^3) = 1/27.	9-12.A-SSE.1 - 4 Interpret the structure of expressions. Write expressions in equivalent forms to solve problems.

Student Friendly Language:

I can use the properties of integer exponents to write equivalent numerical expressions.
I can multiply and divide numerical expressions with integer exponents.
I can explain the difference between a positive and negative exponent.
I can simplify an expression so that it does not contain negative exponents.
I can represent a real world situation using integer exponents.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Positive exponents • Negative exponents • Product of Powers Rule • Power of Powers Rule • Quotient of Powers Rule • Properties of integer exponents • Equivalent numerical expressions • Simplified expression	Positive exponents are repeated multiplication. Negative exponents are repeated division. Rewriting a numerical expression using the properties of integer exponents does not change its value. A simplified expression will not contain negative exponents.	Apply the properties of powers. Write equivalent numerical expressions. Identify equivalent expressions containing integer exponents. Write repeated multiplication/division expressions using powers. Write powers using repeated multiplication/division expressions. Apply the properties of integer exponents to simplify expressions. Recognize incorrect use of integer exponents. Represent real world situations using integer exponents.

Key Vocabulary:

Base Negative exponents Negative integers Numerical expressions Numerator Positive exponents Positive integers Product of Powers Rule Integer Properties of integer exponents Powers Quotient of Powers Rule Denominator Rational numbers Reciprocal Square Cube Equivalent Estimate Expression Exponents

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"?

Exponential Growth: Apply integer exponents to represent the growth of various organisms and insects that affect the productivity of farm land.

Science: Represent and compare interplanetary distances using exponents. Represent and compare the size of microscopic organisms. Radioactive decay in the nuclear power plants affected by the Japanese Tsunami

Calculating compound interest

Population grown: birth of 7 billionth person on earth based on an exponential growth model, bacteria, cold virus

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressions and Equations	**Cluster:**	Work with radicals and integer exponents	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
None	8.EE.2 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 and cube roots of small perfect cubes. Know that √2 is irrational.	9-12.N.RN.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define 5^(1/3) to be the cube root of 5 because we want [5^(1/3)]^3 = 5^[(1/3) x 3] to hold, so [5^(1/3)]^3 must equal 5. 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).

Student Friendly Language:

I can use square root symbols to write and solve equations. $x^2 = p$ (p is a positive number) $x^2=64$
I can use cube root symbols to write and solve equations. $x^3 = p$ (p is a positive number) $x^3 = 8$
I can evaluate square roots of perfect squares. $\sqrt{25} = 5$
I can evaluate cube roots of perfect cubes. $\sqrt[3]{27} = 3$
I can describe irrational numbers. $\sqrt{2}$, $\sqrt{31}$, $\sqrt{42}$

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Perfect Cube • Square Root • Cube Root • Irrational Numbers • Perfect Squares • Radical	Square roots and raising a number to the second power are inverse operations. Irrational numbers cannot be written in the form of a/b. Rational numbers can be written in the form of a/b. There is a possibility of 2 roots for every square root. (one positive & one negative) There is a relationship between square roots and perfect squares. There is a relationship between cube roots and perfect cubes. Cube roots and raising the number to the third power are inverse operations.	Solve equations of cube roots. Solve equations of square roots. Explain the relationship between perfect squares and square roots. Classify numbers as rational or irrational. Draw a square to show that the area of squaring an integer is the inverse of taking the square root. Model with the use of base ten blocks the fact that volume of a cube can help you find the length of a side of cube by taking the cube root. Evaluate equations using variables that are squared or cubed by taking the square root or cube root.

Key Vocabulary:

Prime factorization	Factorization	Perfect square	Square root	Perfect cube	Cube root
Rational numbers	Irrational numbers	Integer	Whole number	Inverse operation	Radical sign

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 side length of a cube.

Find how many small cubic boxes can fit into a larger box

How many square foot tiles would be needed to cover a 9 ft by 9 ft room?

You have 64 square feet of carpet, what are the possible dimensions of the square room?

Scale models in architecture.

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressions and Equations	**Cluster:**	Work with radicals and integer exponents	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
Introduction	8.EE.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3 × 10^8 and the population of the world as 7 × 10^9, and determine that the world population is more than 20 times larger.	Terminates

Student Friendly Language:

I can write numbers in scientific notation.

I can estimate very large or very small quantities using scientific notation.

I can compare numbers written in scientific notation.

I can convert decimal numbers into scientific notation or scientific notation into decimal numbers

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Scientific notation • Positive exponents • Negative exponents • Multiply by power of 10	Very small or very large numbers can be written using scientific notation. Numbers written in scientific notation represent real values that can be compared to one another. A negative exponent in a power of ten means to move the decimal point to the left that number of decimal places. A positive exponent in a power of ten means to move the decimal point to the right that number of decimal places.	Write very large or very small numbers in scientific notation. Estimate very large numbers using positive exponents in scientific notation. Estimate very small numbers using negative exponents in scientific notation. Estimate how many times larger one number is versus a second number.

Key Vocabulary:

Estimate	Power of 10	Positive exponents	Negative exponents	Integer	Scientific notation

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”?

Science applications: distance between planets, diameter of nucleus, size of neutrino, speed of sound

Population comparisons. Estimate the population of the United States as 3 × 10^8 and the population of the world as 7 × 10^9, and determine that the world population is more than 20 times larger.

The chart shows estimates of computer storage. A CD-ROM holds 700 MB of data. A DVD-ROM holds 4.7 GB. Estimate how many times more storage is in the DVD than a CD. Explain how you got your answer.

1 KB = 1000 bytes

1 MB = 1 million bytes

1 GB = 1 billion bytes

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressions and Equations	**Cluster:**	Work with radicals and integer exponents	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.EE.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, a + 0.05a = 1.05a means that “increase by 5%” is the same as “multiply by 1.05.”	8.EE.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.	9-12.N.Q.2 Define appropriate quantities for the purpose of descriptive modeling.

Student Friendly Language:

I can perform operations with numbers expressed in scientific notation.

I can solve problems where decimals and scientific notation are used.

I can use scientific notation and choose units of appropriate size for measurement.

I can interpret the answer from a technology tool if it is given in scientific notation.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Scientific Notation • Measurements using scientific notation • Conversions between scientific notation and decimal notation. • Properties of integer exponents	Exponents must be the same when adding and subtracting scientific notation. You add exponents when you multiply powers. You subtract exponents when you divide powers. You can convert decimals to scientific notation before evaluating. Technology devices may display scientific notation in a different format. When a number is very large choosing the larger unit of measure is more meaningful and when the number is very small the smaller unit of measure is more meaningful.	Analyze a number to make sure that it is written appropriately in scientific notation. Apply properties of integer exponents when adding, subtracting, multiplying, and dividing numbers that are in scientific notation. Perform operations with numbers where both decimal and scientific notations are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology.

Key Vocabulary:

Scientific notation	Rules of powers	Measurement labels	Sum	Difference
Product	Quotient	Technology notation	Exponents	

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”?

Correlate with Science class. Given the distance from the sun to a planet, write that number in scientific notation. What would be an appropriate unit of measurement?

What does 3.4 EE -6 mean when displayed on your calculator?

$\frac{3.8 \times 10^{8}}{2.9 \times 10^{3}}$ $29{,}300{,}000 + 8.9 \times 10^{7}$

In July 2010 there were approximately 500 million facebook users. In July 2011 there were approximately 750 million facebook users. How many more users were there in 2011. Write your answer in scientific notation.

Solution: Subtract the two numbers: 750,000,000 - 500,000,000 = 250,000,000 2.5 x 10^8

Subtract the two numbers: 750,000,000 - 500,000,000 = 250,000,000 2.5 x 10^8

The speed of light is 3 x 10^ 8 meters/second. If the sun is 1.5x 10^11 meters from earth, how many seconds does it take light to reach the earth? Express your answer in scientific notation.

8 meters/second. If the sun is 1.5x 10^11 meters from earth, how many seconds does it take light to reach the earth? Express your answer in scientific notation.

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressions and Equations	**Cluster:**	Understand the connections between proportional relationships, lines, and linear equations	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.EE.4 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; 7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.s, areas, and other quantities measured in like or different units.; 7.RP.2 Recognize and represent proportional relationships between quantities.	8.EE.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.*	9-12.FLE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.; A-CED.2.Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. 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.*

Student Friendly Language:

I can graph proportional relationships.

I can determine and describe the unit rate as the slope of the graph.

I can compare two different proportional relationships using different models such as graphs, equations, or tables.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Proportional relationships • Slope of the graph • Unit rate as the slope	Proportional relationships can be represented using graphs, tables, or equations. Proportional relationships starts at the origin (0,0). Slope represents the rate of change of one variable with respect to another. Interpret the slope in terms of the context of the situation. Unit rate is the slope of the line. Unit rate is a coefficient of x.	Graph the proportional relationships using tables, or equations. Find the slope given a set of information (i.e. graphs, tables, or equations.) Read the graph to determine how to label the slope. Compare the unit rate of proportional relationships.

Key Vocabulary:

Proportional relationships	Slope (m)	Line	Graph	Rate of change
Origin	Equation	Unit rate	Tables	Coefficient

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”?

There will always be times that a concrete number answer will give you the best comparison between two different events. Sometimes graphical representations are the best tool to compare and visualize two or more situations.

If I tilled a field at 3 mph and tilled another of equal size at the rate of 5 mph what is the difference in time spent tilling the field? What is the difference in diesel expense between the two if you burn fuel at 4 gallons per hour or 5 gallons per hour? Create a graph representing the different relationships.

`SD Common Core State Standards Disaggregated Math Template

Domain:	Expressions and Equations	**Cluster:**	Understand the connections between proportional relationships, lines, and linear equations	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.RP.2 Recognize and represent proportional relationships between quantities. 7.G.1 Solve problems involving scale drawings of geometric figures.	8.EE.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y =mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.	9-12.A-CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales 9-12.F-LE.1b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another 9-12.F-LE.2 Construct linear functions including arithmetic and geometric sequences, given a graph, description of a relationship, or two input-output pairs (including reading these from a table) 9-12.G-GPE5 Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems(e.g. find the equation of a line parallel or perpendicular to a given line that passes through a given point)

Student Friendly Language:

I can use similar triangles to explain why the slope (m) is the same between any two points on a non-vertical line.

I can create the equation y=mx for a line through the origin.

I can create the equation y=mx+b for a line that passes through the y axis at b [b represents the ordered pair (0,b)].

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Relationship between similar triangles and slope • Zero slope • Undefined slope • Equation y=mx • Equation y=mx+b • Non-vertical • Vertical lines	Similar triangles can be used to find the slope of a line. A zero slope is a horizontal line. An undefined slope is a vertical line. The equation y=mx passes through the origin. The equation y=mx+b passes through the y axis at b. Non-vertical lines can be written in the form y=mx or y=mx+b. Vertical lines have no slope and cannot be written using these equations.	Draw similar triangles on a non-vertical line to show that the slope of the line is constant. Explain the difference between a zero slope and an undefined slope. Derive an equation for y=mx. Derive an equation for y=mx+b. Understand the difference between the slope of a non-vertical and vertical line.

Key Vocabulary:

Similar triangles Slope Pitch Non-vertical line Vertical axis Equation Distinct points
Vertical line Horizontal line Origin Slope intercept form (y=mx+b) Zero slope Undefined slope

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"?

Extending the length of an existing skateboard ramp

Pitch of a roof

Road construction – road grades and bridges

Surveyors

Business plan (when you would break even and begin to earn)

Staircase - distance up against span

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressions and Equations	**Cluster:**	Analyze and solve linear equations and pairs of simultaneous linear equations	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations as strategies to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. For example: If a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation. 7.EE1, 4a 1. Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. 4a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?*	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.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.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Student Friendly Language:

I can solve linear equations in one variable by using inverse operations, the distributive property, and combining like terms.

I can give examples of equations in one variable that have one solution, no solutions, or infinitely many solutions.

I can solve equations that have rational coefficients (integers, fractions, or decimals).

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Solving linear equations • Solutions of linear equations • Rational coefficients	Linear equations can be solved by using inverse operations. Linear equations can be solved using the distributive property. Linear equations can be solved by combining like terms. Linear equations in one variable can have one solution, infinitely many solutions, or no solution. Rational coefficients include integers, fractions, and decimals.	Apply inverse operations to solve linear equations Apply the distributive property to solve linear equations. Combine like terms to solve linear equations. Give examples of equations with one solution, infinitely many solutions, and no solutions. Solve linear equations that have rational coefficients.

Key Vocabulary:

Linear equation	Variable	Coefficient	Like terms	Distributive property
Inverse operations	Rational numbers	Infinitely many solutions	Simplest form	Equivalent 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"?

Students could compare two payment plans for cell phone service or movie/media services. The distributive property could be illustrated through an example of purchasing items and sales tax.

An example of an equation in which there are infinitely many solutions would be an age puzzle. One puzzle would be if you start with your age, multiply by two, add eight, divide by two, and then subtract 4, you will end up with your age as an answer.

An example of an equation in which there is no solution would be the question "My brother was born two years before me. When we will be the same age?" (x = x +2)

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressions and Equations	**Cluster Heading:**	Analyze and solve linear equations and pairs of simultaneous linear equations	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
None	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-REI.5-10 Solve systems of equations.

Student Friendly Language:

I can solve a linear system by graphing.

I can solve a linear system by using algebra.

I can check the algebraic solution by graphing the two linear equations.

I can show that there are systems of equations that have one solution, no solutions, or an infinite number of solutions.

I can apply my knowledge of systems of equations to real world situations.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Solving a linear system by graphing • Solving a linear system by using algebra • Estimate solutions • Solutions of a linear system • Solve real world problems	The intersection point of two lines in a coordinate plane is the solution to the system of linear equations. A system of linear equations can be solved algebraically, using elimination or substitution. The algebraic solution of the linear system can be estimated by graphing. A system of linear equations can have one solution, infinitely many solutions, or no solutions. A linear system can represent a real world problem.	Graph a system of two linear equations. Find the point of intersection of the two linear equations. Solve a linear system using elimination or substitution. Estimate the algebraic solution by graphing. Determine how many solutions there are to a linear system. Write and solve a system of linear equations to model a real world situation.

Key Vocabulary:

Algebraically Coordinate Coordinate plane Coincide Elimination method
Estimate, graphs Infinite many solutions Intersection Linear equation No solution
Number of solution Ordered pair Parallel lines Simultaneous Slope-intercept
Solution of linear equations Substitution method System of linear equations Vriables

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"?

Compare Payment Plans: Determine which company has the better deal if one company offers a cell phone plan with a $49.99 monthly fee for 400 minutes and charges $0.03 per minute over 400 minutes or a second company that offers a cell phone plan with a $69.99 monthly fee for 700 minutes and charges $0.05 per minute over 700 minutes. Or compare two different rates for a cab ride.

Exchange Rates: Examine the exchange rates between two different monetary systems.

Fuel Efficiency: Compare graph of gas usage in town to gas usage on highway; Compare fuel efficiency of different types of vehicles for example a car compared to a truck

Expense –Income Graphs: find the point at which a business breaks even

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Define, evaluate, and compare functions	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
None	8.F.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.	9-12.F.IF.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).ing to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*). *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).

Student Friendly Language:

I can identify a function.

I can understand that in a function every input value has exactly one output value.

Know (Factual)	**Understand (Conceptual) I want students to understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Function • Input is *x* • Output is *y* • Vertical line test	In a function, for every input value there is exactly one output value. The graph of a function is a set of ordered pairs.	Identify functions from equations, graphs, and tables/ordered pairs. Show that the input of a function has exactly one output value. Identify graphs as functions using the vertical line test.

Key Vocabulary:

Function y-value x-value Vertical line test Input Output Linear function Non-linear 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"?

Which of the following represent functions?

1. {(0, 2), (1, 3), (2, 5), (3, 6)}
2.

x	y
0	3
1	9
2	27

3.

x	y
16	4
16	-4
25	5
25	-5

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	Cluster:	Define, evaluate, and compare functions	Grade level:	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
None	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.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.* 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.

Student Friendly Language:

I can explain, compare and contrast properties and characteristics of functions given in different ways.

I can match the same function to different representations of that function..

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Properties of a function • Characteristics of a function • Graphs, tables, equations, and verbal descriptions of functions	Functions can be represented in multiple ways. Different representations can be used to compare functions to draw conclusions and make applications. A relationship between tables, graphs, and equations can be found by looking at similarities and differences.	Compare properties and draw conclusions from different representations of functions. Create equations and write functions for graphs, tables, and verbal descriptions of a function. Explain the purpose of representing a function in multiple ways.

Key Vocabulary:

Rate of change	Slope	Coordinate plane	x-coordinate	y-coordinate	x-axis
Function table	T-chart	Graph	Equation	Dependent variable	y-axis
Independent variable	Origin	Ordered pair	Equivalent		

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"?

1. Do test scores relate to the amount of time studying? How much studying do you need to do compared to the rest of the class in order to improve your test scores? How does the relationship between your study time and your friend's study time compare? Who needs to study more to achieve an A?

2. You make $5 an hour at your part time job walking dogs. Your friend makes $6.50 washing cars. You have already saved $15, and your friend has saved nothing. How many hours will each of you have to work to save enough money for the ski trip that costs $150? Who has to work more hours?

3. Joe needs to hire a plumber to fix his toilet, but only has $300 saved. Pete's Plumbing charges $75 initial fee plus $50 an hour. Young's Plumbing charges $60 per hour. Which company would be best for Joe to hire?

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Define, evaluate, and compare functions	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour.* 7.RP.2. Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.* Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.* d. 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. 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. *r)* where *r* is the unit rate.	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.*	9-12.F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).*

Student Friendly Language:
I can recognize that a linear function forms a straight line. I can recognize that an equation in the form y=mx+b is a linear function. I can give examples of linear and non-linear equations. I can demonstrate through a graph that a function is not linear.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Linear function • Nonlinear function • y= mx + b • y-intercept • Slope	All equations that fit into the form y=mx + b are linear. All equations are either linear or nonlinear. Understand that linear functions have a constant rate of change between any two points.	Identify the slope and y-intercept of a linear equation in the form of y=mx+b. Explain the relationship between linear and nonlinear functions using tables, graphs, and equations in the form y=mx+b Use equations, graphs and tables to categorize functions as linear or nonlinear.

Key Vocabulary:

Rate of change	Slope	y-intercept	Unit rate	Coordinate plane	Linear function
Nonlinear function	Function table	Equation	Ordered pair	y=mx+b	

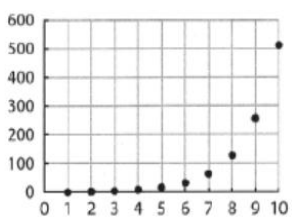
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?

Determine if the functions listed below are linear or nonlinear. Explain your reasoning.

1. $y = -2x^2 + 3$
2. $y = 0.25 + 0.5(x - 2)$
3.

X	Y
1	12
2	7
3	4
4	3
5	4
6	7

4.



5. $A = \square r^2$

Solutions:

1. Nonlinear
2. Linear
3. Nonlinear
4. Nonlinear
5. Nonlinear

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Use functions to model relationships between quantities.	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.EE.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05.* 7.EE.4 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. a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width	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. 9-12.F-BF.1 Write a function that describes a relationship between two quantities. a Determine an explicit expression, a recursive process, or steps for calculation from a context. 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. 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. 9-12 F -LE. 1. Distinguish between situations that can be modeled with linear functions and with exponential functions. a Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

Student Friendly Language:

I can write an equation to show a linear relationship between two quantities based on a graph or table.

I can find rate of change and initial value of a linear function when given the description of a situation or two points.

I can read a table or a graph and find an ordered pair that fits into the function.

I can explain the meaning of the rate of change and the initial value of a linear function from a table or graph in the context of the situation.

I can use tables or graphs to find the rate of change and initial values.

I can model linear functions and explain the meaning using graphs, tables, and equations.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Linear relationship • Initial value • Interpretation of rate of change and initial value	Functions can be used to model linear relationships between quantities. Linear functions can be used to explain rate of change and initial value. There is a relationship between two quantities to be modeled. The slope is used to determine the rate of change. The y-intercept is used to determine the initial value.	Construct a function to model a linear relationship using different forms Determine the initial value of a linear function from a graph or a table. Calculate rate of change of a line given a description of a relationship or two ordered pairs Explain the meaning of the rate of change and initial value of a linear function based on the context, graph or table

Key Vocabulary:					
Function	Table	Graph	Equation	Rate of change	Linear
Initial value	Ordered pair	Linear relationship	x-intercept	y-intercept	Slope-intercept form

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"?

1. A 6 ft. pool contains 1 foot of water at 10am. If the pool fills 6 inches every 15 minutes, what time will the pool be full?

2. Farmer Brad has a 500 gallon fuel tank. Cenex can fill the tank at 4 gallon every minute. If Farmer Brad has 20 gallons left in the tank, how long will it take to fill the tank?

3. You have been studying for a test. You have to get through 30 pages of notes. You have already read through 6 pages. If you study five pages an hour, how long will it take to finish your studying? How long will you have studied after studying 28 pages? If you finish studying at 9:15 pm, what time did you start studying?

4. You are saving some money for an iPhone. You need to save a total of $250. Your job at Dairy Queen earns you $7.50 per hour. You have worked for 10 hours, and you only need $100 more. How much money did you have when you started working?

5. Use the information in the following table of times and temperatures to find the rate of change of the function.

Time	6:00 a.m.	8:00 a.m.	10:00 a.m.	12:00 p.m.	2:00 p.m.
Temperature	45◦	50◦	55◦	60◦	65◦

SD Common Core State Standards Disaggregated Math Template

Domain:	Functions	**Cluster:**	Use functions to model relationships between quantities	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.RP.2 Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn. d. 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.	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.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. 9-12.F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. • 9-12.F.LE.1a- Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. • 9-12.F.LE.1b- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. • 9-12.F.LE.1c- Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

Student Friendly Language:
I can describe how the two variables are related using a graph. I can distinguish when a graph is increasing or decreasing. I can sketch a graph when given a verbal description of it. I can identify and interpret the meaning of x- and y-intercepts of a graph.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
• Increasing functions • Decreasing functions • x-intercept • Varying rates of change	A function is a relationship between two variables. A change in one variable will cause a change in the other variable. There is a relationship between the rate of change and the direction of the graph. Functional relationships between two quantities have meaning and can be represented by a graph and described verbally.. Functions may be increasing or decreasing.	Draw a graph based on a description of the relationship between two quantities. Analyze/investigate the intervals on a graph where changes (increase, decrease) are occurring and make conjectures about possible causes of the change Analyze the relationship between two quantities shown on a graph.

Key Vocabulary:			
Coordinate plane	Linear function	Non-linear function	Increasing
Decreasing	x-intercept	y-intercept	Constant

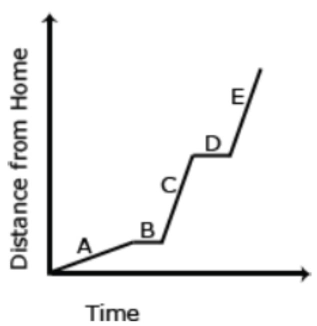
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?

1. Based upon the graph of water in a tub, verbally describe what is happening between the two variables. On what segment is the water depth decreasing at the slowest rate/fastest rate? How can you tell?

2. Given this scenario, sketch a graph:

Mary started walking to school at a leisurely pace. She stopped to tie her shoe. Then she realized she was going to be late, so she started to run. After running for a minute she became tired and slowed to a fast walk. After 10 total minutes, she arrived at school.

3. The graph below shows a John's trip to school. He walks to his Sam's house and, together, they ride a bus to school. The bus stops once before arriving at school.
   Describe how each part A – E of the graph relates to the story.



Solution:
A John is walking to Sam's house at a constant rate.
B John gets to Sam's house and is waiting for the bus.
C John and Sam are riding the bus to school. The bus is moving at a constant rate, faster than John's walking rate.
D The bus stops.
E The bus resumes at the same rate as in part C.

3. Give the students a stop watch, have them walk a specified route and mark their time as specified locations. They will then graph their data and compare their graphs to others.

4. Follow and graph the grain, cattle, stock prices over a period of time. Analyze the graphs, make conjectures about the causes of changes in the graphs, compare the graphs of the different commodities.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Understand congruence and similarity using physical models, transparencies, or geometry software	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.G.2 Draw (freehand, with ruler and protractor, and with technology) geometric shapes with 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.	8.G.1 Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines.	9-12.G-CO.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another

Student Friendly Language:

I can experiment with rotations, reflections, and translations.
I can rotate, reflect, and translate lines keeping them the same length.
I can rotate, reflect, and translate line segments keeping them the same length.
I can rotate, reflect and translate angles keeping their measures the same.
I can rotate, reflect, and translate parallel lines keeping them parallel.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Properties of rotations • Properties of reflections • Properties of translations	It is important to be able to experiment with rotations.	Explain what a rotation is.
	It is important to be able to experiment with reflections.	Explain what a reflection is.
	It is important to be able to experiment with translations.	Explain what a translation is.
	A line segment can be rotated, reflected, and translated and remain the same length.	Rotate, reflect, and translate a line segment of the same length.
	Angles can be rotated, reflected, and translated and still have the same measure.	Rotate, reflect, and translate an angle that has the same measure.
	Parallel lines can be rotated, reflected, and translated and still remain parallel.	Rotate, reflect, and translate parallel lines.

Key Vocabulary:

Properties	Rotations	Reflections	Translations	Lines	Line segments
Angle	Parallel lines	Experiment	Verify	Rigid	Transformations

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"?

At home/Real-World: Having a student explain to their parent why when you look in a mirror, everything is the opposite of what it seems.

Students will measure the distance from the ceiling to two certain spots on the wall to hang a picture straight.

Students will understand that the angle measures of their rooms corners are all the same.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Understand congruence and similarity using physical models, transparencies, or geometry software	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
None	8.G.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.	9-12.G-CO.6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent

Student Friendly Language:
I can draw congruent two-dimensional figures. I can explain what a two-dimensional figure is. I can describe a sequence that exhibits congruence when given two congruent figures.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Congruent two-dimensional figures • Rotations of congruent two-dimensional figures • Reflections of congruent two-dimensional figures • Translations of congruent two-dimensional figures • Sequence of congruent figures	Two-dimensional figures are congruent if corresponding sides and angles are equal. A two-dimensional figure is congruent to another if the second one can be obtained from the first by a sequence of rotations. A two-dimensional figure is congruent to another if the second one can be obtained from the first by a sequence of reflections. A two-dimensional figure is congruent to another if the second one can be obtained from the first by a sequence of translations. A two-dimensional figure is congruent to another if the second one can be obtained from the first by a sequence of rotations, reflections, or translations. When given two congruent figures, they can describe a sequence that exhibits the congruence between them.	Explain that congruent figures have the same shape and size. Explain how a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations. Explain how a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of reflections. Explain how a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of translations. Describe a sequence that exhibits congruence.

Key Vocabulary:			
Two-dimensional figures	Congruent	Congruent figures	Sequence
Rotations	Reflections	Translation	Congruence

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"?

At home/Real-World: Having your child use the tools necessary to draw a two-dimensional figure, such as a dog house or television.

Once your child has drawn a two-dimensional figure, have them show you a rotation, reflection, and translation of the figure.

Have your students construct two congruent figures.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Understand congruence and similarity using physical models, transparencies, or geometry software	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.G.2.1 Students are able to demonstrate ways that shapes can be transformed.	8.G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	9-12.G.CO.2 Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).

Student Friendly Language:
I can describe the effect of dilations on two-dimensional figures using coordinates. I can describe the effect of translations on two-dimensional figures using coordinates. I can describe the effect of rotations on two-dimensional figures using coordinates. I can describe the effect of reflections on two-dimensional figures using coordinates.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Dilations of two-dimensional figures using coordinates • Translations of two-dimensional figures using coordinates • Rotations of two-dimensional figures using coordinates • Reflection of two-dimensional figures using coordinates	It is important to be able to describe the effect of dilations on two-dimensional figures using coordinates. It is important to be able to describe the effect of translations on two-dimensional figures using coordinates. It is important to be able to describe the effect of rotations on two-dimensional figures using coordinates. It is important to be able to describe the effect of reflections on two-dimensional figures using coordinates.	Explain what a dilation is. Explain what a translation is. Explain what a rotation is. Explain what a reflection is. Create a dilation of a two-dimensional figure using coordinates. Create a translation of a two-dimensional figure using coordinates. Create a rotation of a two-dimensional figure using coordinates. Create a reflection of a two-dimensional figure using coordinates.

Key Vocabulary:					
Dilation	Translations	Rotations	Reflections	Two-dimensional figures	Coordinates

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”?

At home/Real-World: When going on the ferris wheel at Valley Fair, a student can explain to their parents that the ride is a rotation.

Draw a waterslide and describe to fellow classmates how the waterslide is a translation.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Understand congruence and similarity using physical models, transparencies, or geometry software	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.G.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	9-12.G.SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

Student Friendly Language:

I can draw two similar two-dimensional figures.
I can explain what rotations are.
I can explain what reflections are.
I can explain what translations are.
I can explain what dilations are.
I can describe a sequence that exhibits the similarity between two similar two-dimensional figures.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Similar two-dimensional figures • Rotations of similar two-dimensional figures • Reflections of similar two-dimensional figures • Translations of similar two-dimensional figures • Dilations of similar two-dimensional figures • A sequence that describes similar two-dimensional figures	Two-dimensional figures are similar if corresponding sides are proportional and corresponding angles are congruent. A two-dimensional figure is similar to another if the second one can be obtained from the first by a sequence of rotations. A two-dimensional figure is similar to another if the second one can be obtained from the first by a sequence of reflections. A two-dimensional figure is similar to another if the second one can be obtained from the first by a sequence of translations. a two-dimensional figure is similar to another if the second one can be obtained from the first by a sequence of dilations. A two-dimensional figure is similar to another if the second one can be obtained from the first by a sequence of rotations, reflections, translations, and/or dilations. When given two similar figures, you can describe a sequence that exhibits the similarity between them.	Understand similar two-dimensional figures. Explain how a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations. Explain how a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of reflections. Explain how a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of translations. Explain how a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of dilations. Explain how a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations and/or dilations. Draw two similar two-dimensional figures, and then describe a sequence that exhibits similarity between them.

Key Vocabulary:

Two-dimensional figures	Similar	Similar figures	Congruent	Proportional	Sequence
Rotations	Reflections	Translations	Dilations	Similarity	

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”?

At home/Real-World: A student will show his classmates his pupils while standing in the lit classroom. He will then walk into a dark room for a minute, and come back out, quickly showing his classmates the current size of his pupils (demonstrating dilation).

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Understand congruence and similarity using physical models, transparencies, or geometry software	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.G.2 Draw (freehand, with ruler and protractor, and with technology) 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.5 Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	8.G.5 Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.	9-12.G-SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. 9-12.G.SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

Student Friendly Language:

I can find the measure of any angle in a triangle if I know the measure of the other two angles.
I can find the measure of any exterior angle of a triangle if I know the measure of the adjacent interior angle.
I can find the measure of any exterior angle of a triangle if I know the measures of the two interior angles of the triangle.
I can identify corresponding, alternate interior, and alternate exterior angles that are formed when two parallel lines are cut by a transversal.
I can recognize that angle pairs have the same measure (are congruent).
I can recognize that two triangles with two pairs of congruent angles will be similar to each other.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Interior angles of triangles • Exterior angles of triangles • Triangle Sum Theorem • Exterior Angle Theorem • A transversal cuts parallel lines • Corresponding angles • Alternate interior angles • Alternate exterior angles • Congruent angle pairs • Angle-Angle Similarity Theorem	Given two interior angle measurements for any triangle, you can find all interior and exterior angle measurements for that triangle. The sum of the measures of the three angles in any triangle is 180 degrees. The measure of an exterior angle of a triangle is equal to the sum of the measures of the other two interior angles. A transversal is the line that cuts two parallel lines. Parallel lines that are cut by a transversal form corresponding angles. Parallel lines that are cut by a transversal line form alternate interior angles. Parallel lines that are cut by a transversal line form alternate exterior angles. Parallel lines that are cut by a transversal line form congruent corresponding angles, alternate interior angles, and alternate exterior angles. When two angles of one triangle are congruent to two angles of another, the triangles are similar	Construct various triangles and find the measure of the interior and exterior angles. Find the measure of missing angles in a triangle. Find the measure of an exterior angle of a triangle given the measure of its adjacent interior angle or the measure of the two nonadjacent interior angles. Make conjectures about the relationship between the measure of an exterior angle and the other two interior angles of a triangle. Identify a transversal. Construct a transversal line of two parallel lines, and classify the angles as corresponding, alternate interior, or alternate exterior. Identify pairs of alternate interior angles, alternate exterior angles, and corresponding angles when parallel lines are cut by a transversal. Find the measures of all angles formed when a pair of lines is cut by a transversal when given the measure of one of the angles. Determine if two triangles are similar when given the measure of two interior angles of each.

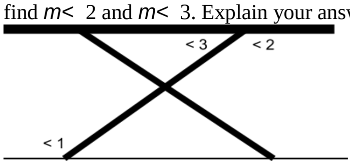
Key Vocabulary:

Vertical angles Adjacent angles Congruent Interior angles Exterior angles
Parallel lines Transversal Alternate interior angles Alternate exterior angles Vertical angles
Supplementary angles Complementary angles Adjacent angles Similarity Similar triangles

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”?

Example 1:

You are building a bench for a picnic table. The top of the bench will be parallel to the ground. If *m* < 1 = 148°, find *m*< 2 and *m*< 3. Explain your answer.



Solution:

Angle 1 and angle 2 are alternate interior angles, giving angle 2 a measure of 148º. Angle 2 and angle 3 are supplementary. Angle 3 will have a measure of 32º so the *m* < 2 + *m*< 3 = 180º

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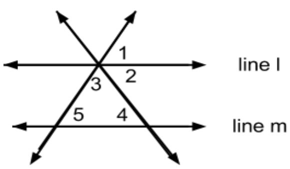
Example 2:

Show that *m*<3 + *m*< 4 + *m* <5 = 180º if line *l* and *m* are parallel lines and *t*1 and *t*2 are transversals.



Solution:

1 + 2 + 3 = 180°

<5 congruent <1 ------- corresponding angles are congruent therefore 1 can be substituted for 5

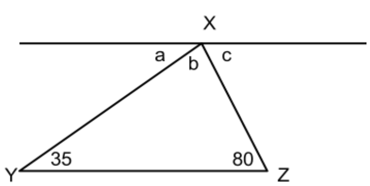
<4 congruent <2 ------- alternate interior angles are congruent therefore 4 can be substituted for 2

Therefore <3 + <4 + <5 = 180°

Students can informally conclude that the sum of the angles in a triangle is 180º (the angle-sum theorem) by applying their understanding of lines and alternate interior angles.

Example 3:

In the figure below Line *X* is parallel to Line *YZ* . Prove that the sum of the angles of a triangle is 180º.

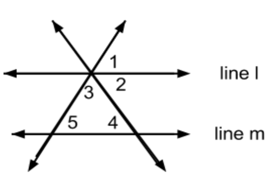


Solution:

Angle *a* is 35º because it alternates with the angle inside the triangle that measures 35º. Angle *c* is 80º because it alternates with the angle inside the triangle that measures 80º. Because lines have a measure of 180º, and angles *a* + *b* + *c* form a straight line, then angle *b* must be 65 º ----->180 – (35 + 80) = 65. Therefore, the sum of the angles of the triangle is 35º + 65º + 80º.

Example 4:

What is the measure of angle 5 if the measure of angle 2 is 45º and the measure of angle 3 is 60º?



Solution:

Angles 2 and 4 are alternate interior angles, therefore the measure of angle 4 is also 45º. The measure of angles 3, 4 and 5 must add to 180º. If angles 3 and 4 add to 105º the angle 5 must be equal to 75º.

Students construct various triangles having line segments of different lengths but with two corresponding congruent angles. Comparing ratios of sides will produce a constant scale factor, meaning the triangles are similar. Students solve problems with similar triangles.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Understand and apply the Pythagorean Theorem	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
None	8.G.6 Explain a proof of the Pythagorean Theorem and its converse.	9-12.G.SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.

Student Friendly Language:
I can prove the Pythagorean Theorem. I can prove the converse of the Pythagorean Theorem.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Leg • Hypotenuse • Pythagorean Theorem • Pythagorean Theorem Converse • Pythagorean Triple	The sides that form the right angle are called legs. The side opposite the right angle, which is always the longest side, is the hypotenuse. For any right triangle, the sum of the squares of the lengths of the legs equals the square of the length of the hypotenuse. If $a^2+b^2=c^2$, then the triangle is a right triangle. A Pythagorean triple is a set of three positive integers a, b, and c such that $a^2+b^2=c^2$. Given the length of any two sides of a right triangle they can calculate the third side using the Pythagorean theorem.	Identify the legs of a right triangle. Identify the hypotenuse of a right triangle. Distinguish right triangles from non-right triangles using the relationship among the side lengths. Find the unknown length of a right triangle. Prove the relationship between the three sides of a right triangle. Use the converse of the Pythagorean to state whether a triangle with given side lengths is a right triangle. Determine whether the 3 numbers form a Pythagorean triple. Find the perimeter and area of a right triangle that has an unknown leg. Calculate the areas of the squares for the sides of a right triangle.

Key Vocabulary:
Leg Hypotenuse Pythagorean Theorem Pythagorean Triple Pythagorean Theorem Converse Right Triangle Square Square Root Area

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"?

Example 1:
The distance from Jonestown to Maryville is 180 miles, the distance from Maryville to Elm City is 300 miles, and the distance from Elm City to Jonestown is 240 miles. Do the three towns form a right triangle? Why or why not?

***Solution*:**
If these three towns form a right triangle, then 300 would be the hypotenuse since it is the greatest distance.
$180^2 + 240^2 = 300^2$
$32400 + 57600 = 90000$
$90000 = 90000$ ✓
These three towns form a right triangle.

Example 2:
A rectangular swimming pool has a length of 41 feet and a width of 11 feet. Tina swims the diagonal distance across the pool. About how far does she swim? Round your answer to the nearest tenth?
***Solution*:**
Use Pythagorean Theorem to find the unknown length which is the hypotenuse. $a^2+b^2=c^2$
$41^2+11^2=c^2$
$1681 + 121 = c^2$
$1802 = c^2$
$42.4499 = c$
C = 42.4 feet

Example 3:
Right triangle ABC has side lengths of 3 inches, 4 inches, and 5 inches. Triangle DEF had double the side lengths of triangle ABC. Triangle TUV has triple the side lengths of triangle ABC.
Make a table of the side lengths, perimeter, and areas of the three triangles. Compare the results.
***Solution*:**

	LEG	LEG	HYPOTENUSE	PERIMETER	AREA
∆ABC	3 in.	4 in.	5 in.	12 in.	6 in^2
∆DEF	6 in.	8 in.	10 in.	24 in.	24 in^2
∆TUV	9 in.	12 in.	15 in.	36 in.	54 in^2

You can see that the perimeters are two and three times the original triangle, but the areas are more than two or three times the original area.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Understand and apply the Pythagorean Theorem	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
None	8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Student Friendly Language:
I can determine unknown side lengths of right triangles in two dimensions. I can determine unknown side lengths of right triangles in three dimensions.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Leg • Hypotenuse • Pythagorean Theorem	Given the length of any two sides of a right triangle they can calculate the third side using the Pythagorean theorem.	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in mathematical problems in two and three dimensions. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world situations in two and three dimensions.

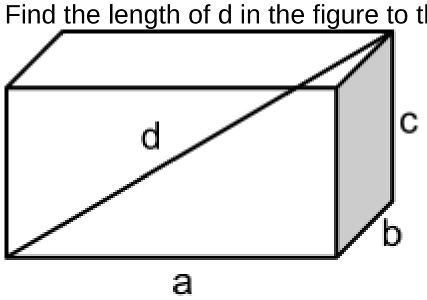
Key Vocabulary:						
Pythagorean Theorem	Legs	Hypotenuse	Right triangle	Square	Square root	Area

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”?

Example 1:
The Irrational Club wants to build a tree house. They have a 9-foot ladder that must be propped diagonally against the tree. If the base of the ladder is 5 feet from the bottom of the tree, how high will the tree house be off the ground?

Solution:
$a^2 + 5^2 = 9^2$
$a^2 + 25 = 81$
$a^2 = 56$
$a = \sqrt{56}$ or ~7.5

Example 2:
Find the length of d in the figure to the right if a = 8 in., b = 3 in. and c = 4in.



Solution:
First find the distance of the hypotenuse of the triangle formed with legs a and b.
$8^2 + 3^2 = c^2$
$642 + 92 = c^2$
$73 = c^2$
$\sqrt{73}$in. = c

The $\sqrt{73}$ is the length of the base of a triangle with c as the other leg and d is the hypotenuse.
To find the length of d:
€
$(\sqrt{73})^2 + 4^2 = d^2$
$73 + 16 = d^2$
$89 = d^2$
$\sqrt{89}$in. = d
Based on this work, students could then find the volume or surface area.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Understand and apply the Pythagorean Theorem	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
None	8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

Student Friendly Language:
I can graph points on a coordinate plane. I can find the distance between two points on a coordinate graph.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Pythagorean Theorem	The horizontal distance between two points is the absolute value of the difference between the x values. The vertical distance between two points is the absolute value of the difference between the y values. They can use the Pythagorean Theorem to find the distance between two points that are not horizontal or vertical distances apart.	Find the distance between two horizontal points on a coordinate plane. Find the distance between two vertical points on a coordinate plane. Find the distance between two points that are not horizontal or vertical distances apart.

Key Vocabulary:
Pythagorean Theorem   x-coordinate   y-coordinate   Absolute value
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"?
1. On the coordinate grid, graph point A at (-2, 0), point B at (0, 5)and point C at (0, 0). Make sure to label the points A, B, and C. Find the length of each side of the triangle. 2. On the coordinate graph, identify the points named by each coordinate pair. Connect points P, Q, and R to make a closed figure. Make sure to label the points. P (0, 4)   Q (-3, 1)   R (0, -2) Find the length of the sides of figure. Show all your work. 3. The driving distance from Spearfish to Pierre can be plotted on a coordinate graph. Spearfish is (0, 0) and Pierre is (212, 38). What is the distance by air?

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.G.7.3 Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids. 7.G.7.4 Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. 7.G.7.6 Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	8.G.9 Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	9-12.G.GMD.1. Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments. G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Student Friendly Language:
I can find the volume of a cylinder. I can find the volume of a cone. I can find the volume of a sphere.

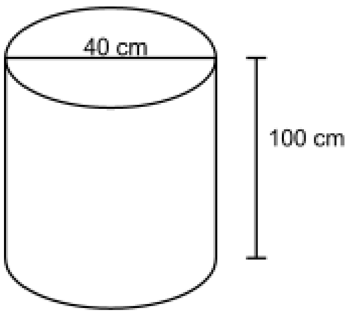
Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Volume of a cylinder • Volume of a cone. • Volume of a sphere	Volume is measured in cubic units. The volume of a cylinder = $\Pi r^2 h$. There is a relationship between the volumes of cylinders, cones, and spheres. The volume of a cone is ⅓ of the volume of a cylinder, V= 1/3 $\Pi r^2 h$. The volume of a sphere is ⅔ the volume of a cylinder V=4/3Πr^3.	Find the volume of a cylinder Find the volume of a cone Find the volume of a sphere Find the volume of a cone that has the same radius and height of a cylinder. Find the volume of a sphere that has the same radius and height of a cylinder.

Key Vocabulary:									
Volume	Area	Circle	Cone	Cylinder	Sphere	Cubic Units	Radius	Height	Pi

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"?

Example 1:

Lisa wanted to plant daisies in her new planter. She wondered how much potting soil she should buy to fill it. Use the measurements in the diagram below to determine the planter's volume.



cylindrical planter

***Solution*:**

$V = \pi r^2 h$

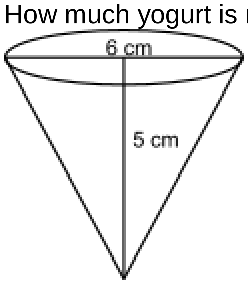
$V = \pi(20^2)(100)$

$V = 3.14(400)(100)$

$V = 125{,}600 \text{ cm}^3$

Example 2:

How much yogurt is needed to fill the cone? Express your answer in terms of pi.



Solution:

$V = ⅓ \pi r^2 h$

$V = ⅓ \pi(3^2)(5)$

$V = ⅓ \pi(3^2)(5)$

$V = ⅓ \pi(9)(5)$

$V = 15\pi \text{ cm}^3$

Example 3:

Approximately how much air would be needed to fill a soccer ball with a radius of 14cm?

Solution:

$V = 4/3\pi r^3$

$V = 4/3(3.14)(14)^3$

$V = 11488.2133 \text{ cm}^3$

$V = 11488 \text{ cm}^3$

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	**Cluster:**	Investigate patterns of association in bivariate data	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.SP.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	8.SP.1 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities.Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	S-ID.6 (a-c) Represent data on two quantitative variables on a scatter plot and describe how the variables are related

Student Friendly Language:

I can make a scatter plot when given information about two variables.

I can describe the data contained in a scatter plot.

I can describe what clustering and outliers mean in a scatter plot.

I can recognize a positive or negative association in a scatter plot.

I can recognize a linear or nonlinear association in a scatter plot.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Scatter plot • Clustering and outliers • Positive and negative associations • Linear and nonlinear associations	Scatter plots can be used to display 2 sets of numerical data. One set is graphed on the x-axis and the other is graphed on the y-axis. They can use the scatter plot to examine relationships between variables. The relationship is linear (positive, negative or no association) or nonlinear.	Construct a scatter plot from 2 variable data. Describe the data in the scatter plot, in particular any clustering or outliers, Describe positive or negative associations apparent in scatter plot. Describe the linear or nonlinear associations of the scatter plot. Make generalizations about the associations found in the data.

Key Vocabulary:

scatter plot	variables	bivariate data	clustering	outliers	positive association
x-axis	y-axis	negative association	linear association	nonlinear association	

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 the hot chocolate sales and the temperature at the football game, sandwich sales and temp and/or lemonade sales and temp, create a scatter plot and describe the association between the two variables

Measure your arm span and height. Combine your data with the class. Create a scatter plot. Describe the association.

Data for 10 students' Math and Science scores are provided in the chart. Describe the association between the Math and Science scores.

Student	1	2	3	4	5	6	7	8	9	10
Math	64	50	85	34	56	24	72	63	42	93
Science	68	70	83	33	60	27	74	63	40	96

Data for 10 students' Math scores and the distance they live from school are provided in the table below. Describe the association between the Math scores and the distance they live from school.

Student	1	2	3	4	5	6	7	8	9	10
Math score	64	50	85	34	56	24	72	63	42	93
Dist from school (miles)	0.5	1.8	1	2.3	3.4	0.2	2.5	1.6	0.8	2.5

.

Data from a local fast food restaurant is provided showing the number of staff members and the average time for filling an order are provided in the table below. Describe the association between the number of staff and the average time for filling an order.

Number of staff	3	4	5	6	7	8
Average time to fill order (seconds)	180	138	120	108	96	84

Thanks to Arizona Dept of Education for several examples

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	**Cluster:**	Investigate patterns of association in bivariate data	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.SP.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	S-ID.6 (a-c) Represent data on two quantitative variables on a scatter plot and describe how the variables are related

Student Friendly Language:

I can use a line to model relationships between two sets of data.

I can see that some scatter plots will resemble a straight line.

I can use a straight line to assess the model fit by judging the closeness of the data points to the line.

Know (Factual)	**Understand (Conceptual)** The students will understand that:	**Do** (Procedural, Application, Extended Thinking)
• Linear association • Informal line of best fit • Modeling data with a linear model	If the relationship suggests a linear association, then a straight line can be used to model the bivariate data . They can assess the model fit by judging how well the data set closely fits the line.	Determine whether a graph of bivariate data resembles a linear association. Model the data by approximating it with a straight line. Determine whether an informal line of best fit in a scatter plot is a good model to use for this data.

Key Vocabulary:

linear association   line of best fit   linear 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"?

Given the following scenarios, informally fit a straight line to the data when it is graphed.   Is the line a good fit to the data? Why or why not?

Measure your arm span and height. Combine your data with the class. Create a scatter plot. Describe the relationship.

Data from a local fast food restaurant is provided showing the number of staff members and the average time for filling an order. Describe the association between the number of staff and the average time for filling an order.

Number of staff	3	4	5	6	7	8
Average time to fill order (seconds)	180	138	120	108	96	84

The capacity of the fuel tank in a car is 13.5 gallons. The table below shows the number of miles traveled and how many gallons of gas are left in the tank. Describe the relationship between the variables. If the data is linear, determine a line of best fit. Do you think the line represents a good fit for the data set? Why or why not?

Miles Traveled	0	75	120	160	250	300
Gallons Used	0	2.3	4.5	5.7	9.7	10.7

Thanks to Arizona Dept of Education

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	**Cluster:**	Investigate patterns of association in bivariate data	**Grade level:**	8

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.SP.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.	S-ID.6 (a-c) Represent data on two quantitative variables on a scatter plot and describe how the variables are related S-ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

Student Friendly Language:

I can create a scatter plot and draw a best fit line for two sets of data.
I can find the slope and y-intercept of the line and write an equation for the line.
I can use the equation to explain what the slope and y-intercept mean.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Linear model • Slope and y-intercept • Equations written in slope-intercept form	They can create an equation for a linear model. They can use the equation to identify the slope and y-intercept. They can interpret what the slope and y-intercept mean for a given situation. They can use the equation to predict what could happen.	Create a linear model by drawing in a best fit line on a graph of bivariate data. Write an equation in slope-intercept form for the linear model. Interpret what the slope and y-intercept represent in a given situation. Predict what could happen when using the equation.

Key Vocabulary:

linear model slope y-intercept slope-intercept form scatter plot line of best fit

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 the following scenarios, informally fit a straight line to the data when it is graphed. Create an equation written in slope-intercept form and interpret what the slope and y-intercept mean.

Measure your arm span and height. Combine your data with the class. Create a scatter plot. Describe the relationship.

Data from a local fast food restaurant is provided showing the number of staff members and the average time for filling an order. Describe the association between the number of staff and the average time for filling an order.

Number of staff	3	4	5	6	7	8
Average time to fill order (seconds)	180	138	120	108	96	84

The chart below lists the life expectancy in years for people in the United States every five years from 1970 to 2005. What would you expect the life expectancy of a person in the United States to be in 2010, 2015, and 2020 based upon this data? Explain how you determined your values.

Date	1970	1975	1980	1985	1990	1995	2000	2005
Life Expectancy (in years)	70.8	72.6	73.7	74.7	75.4	75.8	76.8	77.4

The capacity of the fuel tank in a car is 13.5 gallons. The table below shows the number of miles traveled and how many gallons of gas are left in the tank. Describe the relationship between the variables. If the data is linear, determine a line of best fit. Do you think the line represents a good fit for the data set? Why or why not? What is the average fuel efficiency of the car in miles per gallon?

Miles Traveled	0	75	120	160	250	300
Gallons Used	0	2.3	4.5	5.7	9.7	10.7

Thanks to Arizona Dept of Education for use of examples

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	**Cluster:**	Investigate patterns of association in bivariate data	**Grade level:**	8

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.SP.4 Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.	8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?	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 read a two-way table. I can collect data with two variables. I can count the frequency of the two data sets and display it in a two-way table I can describe whether there is any association between the two variables.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Bivariate categorical data • Two-way table	They can collect bivariate data. They can display frequencies in a two-way table. They can use relative frequencies to make generalizations about the information in the table.	Determine two variables that may be related. Gather bivariate data on the two variables. Construct a two-way table to display the data. Describe possible associations between the two variables. Make generalizations about the associations.

Key Vocabulary:			
bivariate categorical data	two-way table	frequency	relative frequencies

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 table illustrates the results when 100 students were asked the survey questions: Do you have a curfew? and Do you have assigned chores? Is there evidence that those who have a curfew also tend to have chores?

CURFEW

		YES	NO
CHORES	YES	40	10
	NO	10	40

Solution: Of the students who answered that they had a curfew, 40 had chores and 10 did not. Of the students who answered they did not have a curfew, 10 had chores and 40 did not. From this sample, there appears to be a positive correlation between having a curfew and having chores.

Example 1:
Twenty-five students were surveyed and asked if they received an allowance and if they did chores. The table
below summarizes their responses.

	Receive Allowance	No Allowance
Do Chores	15	5
Do Not Do Chores	3	2

Of the students who do chores, what percent do not receive an allowance?
Solution: 5 of the 20 students who do chores do not receive an allowance, which is 25%
5 of the 20 students who do chores do not receive an allowance, which is 25%

Thanks to Arizona Dept of Education

Survey 100 of your classmates with these questions:
1. Do you play in the school band?
2. Are you on the honor roll?

Create a two-way table. Is there evidence that those who play in the school band are also on the honor roll? Justify your answer.

Choose 2 variables which you think might have either a positive or negative association. Create 2 questions. Survey 100 of your classmates. Create a two-way table. Is there evidence that there is an association between the 2 variables. Justify your answer.