SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Experiment with transformations in the plane	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
4.G Draw and identify lines and angles, and classify shapes by properties of their lines and angles. 1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.	9-12.G.CO.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	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 use a point, line, and plane to define angles, perpendicular and parallel lines, and circles.
I can determine if the lines are parallel, perpendicular or neither based on vertical angles, exterior angles, interior angles, alternate angles.
I can use (apply) the symbols for parallel, perpendicular, and angle (⊥ ,| |, and <).

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Precise definitions of angle, circle, perpendicular line, parallel line, and line segment	A point, line, and plane are undefined terms that can be used to build definitions of other terms. A point is non-dimensional, a line is one dimensional, and a plane is two dimensional and space is three dimensional. There is proper notation for an angle, a line, a segment, a ray, a length, and parallel and perpendicular lines.	Demonstrate the knowledge of precise definitions of angles, line, point, plane, circles, perpendicular and parallel lines, and line segments. Calculate the linear distance and arc length. Demonstrate the use of proper notation.

Key Vocabulary:

Parallel lines Perpendicular lines Arc Length Distance along a line Angle
Line Segment Circle Point Line Plane

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

Given a 3D geometric shape determine if sides or planes are parallel, intersecting, or skew for spatial correlation and to recognize relationships.

Satellites orbiting the earth.

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Experiment with transformations in the plane	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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).	F.BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

Student Friendly Language:

I can transform a figure on the xy-plane by using different tools (software, graph paper, etc.).

I can write a function that will transform a figure on the xy plane.

I can determine the difference between dilations, reflections, rotation, and translations.

Know (Factual)	**Understand (Conceptual)** The students will understand that:	**Do (Procedural, Application, Extended Thinking)**
• Types of Transformations: Dilation, Rotation, Reflection, Translation • Transformation Functions • How to construct figures with different transformations using Geometry tools and software • How to determine if a transformation is a rigid transformation or not	To understand the differences and similarities of reflections, rotations, dilations, and translations. To understand that functions can be altered or manipulated to perform transformations.	Alter a function to create a desired transformation Perform a transformation using software, graph paper, etc. Demonstrate understanding by translating any given figure to a desired loci. Show how every function follows the same rules of transformations (exponential, cubic, trigonometric, etc.)

Key Vocabulary:

transformation	translation	dilation	horizontal	vertical	reflection
rotation	xy plane	domain	range	isometric	

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"?

Construction workers are able to scale up a design from a blue print. Apartment buildings, hotel rooms, spec houses are examples of reflections or rotations of geometric figures. Flowers, leaves, and snowflakes can display lines of symmetry through the use of reflection.

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Experiment with transformations in the plane	**Grade level:**	10

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	

Student Friendly Language:

I can rotate a figure.

I can reflect a figure.

I can reflect and rotate a figure.

I can explain how a figure is reflected onto itself.

I can explain how a figure is rotated onto itself

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• How to determine which transformations or series of transformations that will carry an image onto itself (i.e. returning the image back to its original size, shape, and location)	Figures can be rotated around the the center of rotation onto itself. Figures can be reflected over an axis of symmetry back onto itself. Some figures do not have an axis of symmetry Some figures do not have rotational symmetry	Describe rotation(s) that will map a quadrilateral or regular polygon onto itself. (in terms of angle degree) Identify and describe the line(s) which represents the axis of symmetry. Give examples of figures that do/do not have an axis of symmetry. Give examples of figures that do/do not have rotational symmetry. Distinguish between different transformations. Predict a result of a series of transformation.

Key Vocabulary:

Rotate	Reflect	Axis of Symmetry	Line Symmetry	Rectangle
Parallelogram	Trapezoid	Regular Polygon	Center of Rotation	Angle of Rotation

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"?

Graphic design specialists
- A fabric designer may use rotations or reflections to repeat a design throughout a piece of fabric
- Quilting

Construction
- Tile/Brick layers may use these concepts within a wall or floor to create interesting designs

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Experiment with transformations in the plane.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	

Student Friendly Language:

I can explain and demonstrate rotations, reflections, and translations.

I can use rotations, reflections, and translations to manipulate figures to show congruence.

I can explain and demonstrate how transformations are results of manipulations of angles, circles, perpendicular lines, parallel lines, and line segments.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• How to define rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	A circle is produced by the rotation of a segment around its endpoint. Perpendicular lines are produced between vertices when a reflection is performed. Parallel lines are produced between vertices when a translation is performed. An angle or a line segment retain their dimensions when translated, reflected or rotated, but the coordinates change on an XY plane.	Define rotations in terms of angle and direction. Define rotations as movement of radii around the center of a circle. Define reflections such that the line of reflection becomes the perpendicular bisector of the line segment joining the preimage point with its image. Define translations such that the lines joining the vertices of the preimage with the vertices of the image produce parallel lines. Construct transformations of geometric figures using geometry software and/or manipulatives. Observe patterns and develop definitions of rotations, reflections, and translations.

Key Vocabulary:

Transformations Rotations Reflections Translations

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"?

Drawing three dimensional figures for architectural design.

Designing offices or hotel rooms that are mirror images (reflections) of each other.

Designing office or hotel complexes in which the floors are translations and the wings are rotations.

Wallpaper design and installation.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Experiment with transformations in the plane	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8G.1 Verify experimentally the properties of rotations, reflections, and translations: a. Line are taken to lines, and line segments to line segments of the same length. b. Angle are taken to angles of the same measure. 8G.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. 8G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. 8G.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. 8G.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.	9-12.G-CO.5: Given a geometric figure and a rotation, reflection or translation, draw the transformed figure using eg. 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 rotate, reflect and translate a figure.

I can explain how to transform the figure from the given rotation, reflection, or translation.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• How to use Geometric tools and/or software to rotate, reflect and translate a given Geometric figure • How to determine which transformations or sequence of transformations will carry one image onto another	Rotations, reflections, and translations cause predicted transformations of the figures. Figures remain congruent during transformations that are rotated, reflected and transformed. There are many sequences that describe a figure that has been transformed multiple ways.	Using graph paper, tracing paper or geometry software, draw a transformation of a figure by rotating, reflecting and/or translating it. Explain the sequence of steps that have led to a transformation. Explain why a transformation is rigid.

Key Vocabulary:

Rotation Reflection Translation

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"?

Patterns in graphic design (example: wallpaper border)

Reading blueprints

Computer Aided Drawing and Design

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Understand Congruence in Terms of Rigid Motions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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 use geometric descriptions of rigid motions to transform figures.

I can predict the effect of a given rigid motion on a given figure.

I can describe rigid motion transformations.

I can predict the effect of a given rigid motion.

I can decide if two figures are congruent in terms of rigid motions.

I can, given two figures, use the definition of congruence in terms of rigid motion to decide if they are congruent.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• What "rigid transformation" means • How to describe different rigid transformations • How to predict what each rigid transformation will do to a given image • How to determine if two figures are congruent, based on rigid transformations	Rigid motion is a transformation that preserves length, angle measure, and area. Plane figures are congruent if all the corresponding sides and angles are congruent.	Apply rigid motion to construct a congruent figure. Use the definition of rigid motion to indicate if two shapes are congruent.

Key Vocabulary:

Rigid Motion	Congruence	Image	Pre-image
Reflection			
Transformation	Rotations	Translations	Isometry

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"?

Congruent shapes make up repeating patterns. For example, we can see rigid motion in the pattern of quilts and other tessellation projects. Congruent shapes are also common in construction work.

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	Cluster:	Understand Congruence in Terms of Rigid Motions	Grade level:	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	Construct two congruent figures using two corresponding pairs of sides and corresponding pairs of angles. Compare given figures to determine congruence and indicate whether the figures went through a ridge transformation

Student Friendly Language:

I can identify corresponding pairs of angles and sides of two congruent triangles before and after rigid motions.

I can show that two triangles are congruent if corresponding pairs of sides and corresponding pairs of angles are congruent.

I can show that if the corresponding pairs of sides and corresponding pairs of angles of two triangles are congruent then the two triangles are congruent.

I can justify congruence of two triangles using transformation (translation, reflection, rotation).

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Rigid motion (translation, rotation, reflection) • Congruency of triangles • Corresponding parts of triangles • Use corresponding parts to determine if triangles are congruent	Triangles are congruent if and only if the corresponding angles and sides are congruent.	Construct two congruent figures using two corresponding pairs of sides of corresponding pairs of angles. Compare given figures to determine congruence and indicate whether the figure went through a rigid transformation.

Key Vocabulary:

Rigid Motion Congruency Corresponding Parts

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

You can use congruent triangles and CPCTC (Corresponding Parts of Congruent Triangles are Congruent) to measure distances, such as the distance across a river, indirectly.

According to legend, one of Napoleon's officers used congruent triangles to estimate the width of a river.
On the riverbank, the officer stood up straight and lowered the visor of his cap until the farthest thing he could see was the edge of the opposite bank. He then turned and noted the spot on his side of the river that was in line with his eye and the tip of his visor.
The officer then paced off the distance to this spot and declared that distance to be the width of the river!
We can use congruent triangles to prove that he was correct.

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Understand congruence in terms of rigid motions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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. 8.G.3 Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. 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. 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 or triangles.	9-12 G.CO.8 Explain how the criteria for triangle congruence (ASA, SAS, AAS, and SSS) follow from the definition of congruence in terms of rigid motions.	

Student Friendly Language:

I can identify the corresponding parts of congruent triangles.

I can manipulate triangles by using reflections, rotations, and translations.

I can prove two triangles are congruent with SSS, SAS, AAS, and ASA.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● How to use the following to determine congruence of triangles: ○ Side-Side-Side Congruence ○ Side-Angle-Side Congruence ○ Angle-Angle-Side Congruence ○ Angle-Side-Angle Congruence ● How to relate the SSS, SAS, AAS, ASA congruences to rigid motion transformations	● SSS, SAS, and ASA are methods of showing triangle congruency Triangle congruence can be used to determine lengths or angle measures of corresponding parts of congruent triangles. Formulate a method to determine unknown measurements of congruent triangles.	Explain why triangles are congruent using SSS, SAS, and ASA. Formulate a method to determine unknown measurements of congruent triangles. State the approach that you would use to determine to congruency of two triangles given limited parts of triangles. State the approach that you would use to determine the congruence of two triangles.

Key Vocabulary:

Side-Side-Side Congruence Side-Angle-Side Congruence Angle-Angle-Side Congruence
Angle-Side-Angle Congruence Included Angle Included Side

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"?

Congruent triangles can be used in construction, architecture, and engineering fields.

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Prove geometric theorems	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.	

Student Friendly Language:

I can prove theorems about lines and angles.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● Prove line and angle theorems including: ○ Vertical angles are congruent; when a transversal crosses parallel lines, ○ Alternate interior angles are congruent and corresponding angles are congruent; ○ Points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.	Vertical angles are congruent Alternate interior, alternate exterior, and corresponding angles are congruent if and only if parallel lines are cut by a transversal. Points on a perpendicular bisector of a line segment are exactly those that are equidistant from the segment's endpoints Same-side interior angles and same-side exterior angles are supplementary if and only if parallel lines are cut by a transversal perpendicular bisector is perpendicular to a given segment and intersects that segment at its midpoint	Prove the vertical angle theorem and alternate interior angle theorem. Prove corresponding angles are congruent. Prove the converse of the alternate interior angle theorem and the corresponding angle theorem and use it to show that two lines are parallel. Use perpendicular bisectors to locate the circumcenter of a triangle and to find the center of a circle given three points on the circle.

Key Vocabulary:

alternate interior angles alternate exterior angles same side interior angles
same side exterior angles corresponding angles perpendicular bisector
vertical angles linear pair of angles transversal Parallel Perpendicular

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

Given three points on a circular arch use perpendicular bisectors to find the center of the circle to aid in constructing the arch.

In construction, use properties of alternate interior angles and corresponding angles to create congruent angles when using a miter saw.

Study navigational applications involving parallel courses of objects such as ships/planes.

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Prove Geometric Theorems	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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 ngle-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.CO.10 Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*	

Student Friendly Language:

I can prove theorems about triangles are true through hands-on projects, technology tools, and other investigations.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Types of triangles ● Parts of of an isosceles and right triangles ● Properties of the mid-segment of a triangle ● Medians, angle bisectors, perpendicular bisectors, altitudes and the names of their points of concurrency ● Properties of the theorems that go with the points of concurrency of the lines listed above ● How to use the properties of triangles to prove Theorems of triangles	The sum of the measures of the interior angles of a triangle is 180 degrees. The base angles of an isosceles triangle are congruent The segment joining midpoints of two sides of a triangle is parallel to the third side and half the length The medians, angle bisectors, perpendicular bisectors and altitudes of a triangle each have their own distinct points of concurrency The measure of an exterior angle of a triangle is equal to the sum of the measures of its two remote interior angles. Triangles and their special segments have many theorems about their relationships	Use geometric tools to show the sum of the interior angles of a triangle is 180 degrees Construct an isosceles triangle with geometric tools and prove the base angles are congruent Draw a triangle and construct the midsegment by joining the midpoints of two sides of the triangle. Then use geometric tools to explore the properties of that segment. Construct the medians, altitudes, perpendicular bisectors, and angle bisectors in separate triangles to view their corresponding intersections. Use geometric tools or geometric definitions and theorems to prove the measure of an exterior angle is equal to the sum of the measures of its two remote interior angles

Key Vocabulary:

Medians	Angle Bisector	Perpendicular Bisector	Altitude	Base Legs
Hypotenuse	Right triangle	Base angles	Bisector	Isosceles

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 measures of angles or sides in construction and art projects.

Find the center of gravity in a triangle (centroid) to balance the triangle.

Use incenters and circumcenters in city planning to select locations for buildings, water mains, etc.

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Prove Geometric Theorems	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
G.CO.9. Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.	9-12.G.CO.11. Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.	

Student Friendly Language:

I can prove a quadrilateral is a parallelogram by showing opposite sides are the same length, opposite angles are the same measure, and both diagonals divide each other in half.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● definition of quadrilateral ● definition of parallelogram ● properties of parallelograms	If diagonals of a parallelogram are congruent, then the parallelogram is a rectangle. A quadrilateral is a parallelogram by showing that opposite sides are congruent A quadrilateral is a parallelogram by showing that opposite angles are congruent. A quadrilateral is a parallelogram by showing that the diagonals have been bisected. A quadrilateral is a parallelogram by showing that one pair of opposite sides are parallel and congruent. Rhombuses, rectangles and squares are special parallelograms.	prove a quadrilateral is a parallelogram by showing opposite sides are congruent. prove a quadrilateral is a parallelogram by showing opposite angles are congruent. prove a quadrilateral is a parallelogram by showing the diagonals bisect each other. prove that all rectangles are parallelograms with congruent diagonals. prove the theorems of special parallelograms (rectangle, rhombus, square).

Key Vocabulary:

Diagonals (of parallelogram) Parallelogram

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"?

Construction work of all kinds - road, houses, furniture, community annex etc. Art and Interior Design, reconstruction of traffic accidents,

For house building, you can show that the foundation of a house has square corners, parallel sides, opposite angles congruent.

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Make Geometric Constructions	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
Geometry 7.G Draw, construct, and describe geometrical figures and describe the relationships between them. 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 notriangle. Geometry 8.G Understand congruence and similarity using physical models, transparencies, or geometry software. 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.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*	

Student Friendly Language:

I can use a compass and a straightedge, reflective devices, paper folding techniques and geometric software to make lines and circles.

I can use these devices to copy a segment and an angle, bisector of a segment and an angle, construct perpendicular and parallel lines, as well as the perpendicular bisector of a line segment.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*	A compass is used to construct circles of a certain radius. A straightedge is used to construct lines through two points.	Use Geometric tools to construct the following: Congruent segments Congruent angles Perpendicular lines Parallel lines Perpendicular bisectors Angle bisectors

Key Vocabulary:

Compass Reflective device Dynamic geometric software

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

A student wants a board trisected. This would use congruent segments and parallel lines.

Create a blueprint.

SD Common Core State Standards Disaggregated Math Template

Domain:	Congruence	**Cluster:**	Make geometric constructions	**Grade level:**	9-12

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

Student Friendly Language:

I can use a straightedge and a compass to construct an equilateral triangle with the vertices on the circle.

I can use a straightedge and a compass to construct a square with the vertices on the circle.

I can use a straightedge and a compass to construct a regular hexagon with the vertices on the circle.

I can use dynamic geometry software to construct the above polygons.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Inscribed figure • How to construct figures inscribed within circles (More specifically: equilateral triangle, square, regular hexagon)	Regular polygons have congruent sides and angles. Inscribing a geometric shape involves constructing it inside another geometric shape. The center of the circle will also be the center of the inscribed polygon.	Construct an equilateral triangle inscribed within a circle. Construct a square inscribed within a circle. Construct a regular hexagon inscribed within a circle.

Key Vocabulary:

Equilateral Triangles Circles Regular Hexagons Squares Inscribed polygons Basic constructions

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"?

Artistic proportions-golden ratio

Landscaping

Example: planting a design in a circular plot, crop circle designs,

Drafting

SD Common Core State Standards Disaggregated Math Template

Domain:	Similarity, Right Triangles, and Trigonometry	**Cluster:**	Understand similarity in terms of similarity transformations.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor.	9-12.F.TF.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

Student Friendly Language:

I can measure proportional segments.

I can show similarity through dilations.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● scale factor of a dilation ● units of measure ● properties of dilations ● enlargement of a figure ● reduction of a figure ● proportional properties of similar figures ● similarity transformations	A dilation on a geometric figure creates a similar figure. A proportional relationship exists between the pre-image and the image in regards to side lengths, perimeter and area.	Identify the scale factor for a dilation of either an enlargement or reduction. Apply properties of proportions to determine a scale factor. Use appropriate units of measures when converting scale. Verify the properties of dilations by creating geometric shapes of different sizes through the use of transformations

Key Vocabulary:

scale factor	enlargement	reduction	image	pre-image
dilation	center of dilation	similarity	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”?

A student can create a scaled drawing for a kitchen makeover,

A student can design a prototype/model.

A student can utilize similarity transformations in the Graphic Design profession.

SD Common Core State Standards Disaggregated Math Template

Domain:	Similarity, Right triangles, and Trigonometry	**Cluster:**	Understand similarity in terms of similarity transformations.	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
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.SRT.2 Understand similarity in terms of similarity transformations. Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.	9-12.G.SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar

Student Friendly Language:

I can define similarity.

I can explain similarity transformations.

I can explain corresponding angles and sides.

I can use proportionality of corresponding sides and equality of corresponding angles to explain similar triangles.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• how to set up proportions • similarity transformations (translations, rotations, reflections, and dilations) • corresponding sides of similar figures • corresponding angles of similar figures	For triangles to be similar the corresponding angles must be congruent and corresponding sides must be in proportion.	Explain the meaning of similar triangles using similarity transformations. Analyze two given figures to determine if they are similar. Generate a definition of similarity using the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

Key Vocabulary:

corresponding transformations scale factor enlargement reduction image
pre-image dilation center of dilation similarity translation rotation

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

A student can find the height of a flagpole or other real world object by using its shadow length, the student's own shadow length and their height.

A student can utilize similarity transformations to design tiling patterns for bathroom renovations.

A student can utilize similarity transformations in the Graphic Design profession.

SD Common Core State Standards Disaggregated Math Template

Domain:	Similarity, Right Triangles, and Trigonometry	Cluster:	Understand similarity in terms of similarity transformations	Grade level:	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.	9-12.G-SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	N/A

Student Friendly Language:

I can apply similarity transformations (translations, rotations, reflections and/or dilations) to triangles and then verify that corresponding angles remain congruent.

I can verify that the resulting triangles (image) are similar to the original triangles (preimage) to support AA (angle-angle) similarity.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Properties of similarity transformations. • AA similarity criteria.	Triangles retain their similarity after a transformation. Two congruent corresponding angles are all that are needed to prove similarity.	Use transformations as a tool to discover how AA similarity is derived and to make the process more efficient. Use the properties of similarity transformations to explain the justification of AA similarity.

Key Vocabulary:

scale factor	enlargement	reduction	image	pre-image	dilation
center of dilation	similarity	transformations	translation	rotation	reflection

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”?

Relevance can be found in art, construction, engineering, design, drafting, computer programming.

A specific example would be in the construction of rafters or in the design of bridges (some computer applications can be found that allow for bridge design by students).

Students can "apply" similar triangles by using similar triangles and shadows to find the height of the school's flagpole, the goal posts etc.

SD Common Core State Standards Disaggregated Math Template

Domain:	Similarity, Right Triangles, and Trigonometry	**Cluster:**	Prove theorems involving similarity	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.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 determine if two triangles are similar.

I can determine if two lines are parallel.

I can set up and solve a proportion.

I can apply the Pythagorean Theorem.

I can organize and write a mathematical proof, including justification of my argument.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● properties of parallel lines ● properties of similar triangles ● Pythagorean Theorem and its converse ● angle sum theorem for triangles ● properties of transversals	Mathematical proof includes justifications and logical arguments. Creating a physical drawing (picture) might be helpful in writing a proof. They must be careful when setting up a proportion for similar figures (i.e. make sure the proper sides are used when setting up the proportion.) Two triangles can be proved similar using the AA similarity theorem (could be extended to SAS and SSS theorems). In a right triangle, the height drawn from the right angle to the hypotenuse is perpendicular to the hypotenuse.	Prove that two triangles are similar using the AA (could extend to SAS or SSS) similarity theorem. Analyze a proof that two triangles are similar to determine if the argument is valid. Prove various theorems about a triangle's properties.

Key Vocabulary:

parallel lines similar triangles proportionality transversal corresponding angles

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"?

Estimate the height of a building using proportions and similar triangles.

Create an isosceles triangle with your arm and a stick of the same length. Using this we can predict where a tree will land when it is cut down. Holding the stick up in the air with a straight arm out in front of you, view the top of the stick until it lines up with the top of the tree. Where you are standing when the two line up is approximately where the tree would land when cut at the height of your arm. Using similar triangles we can actually calculate the distance.

Use the Pythagorean Theorem to cut correct lengths for right angle construction.

SD Common Core State Standards Disaggregated Math Template

Domain:	Similarity, Right Triangles, and Trigonometry	**Cluster:**	Prove theorems involving similarity	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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. 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.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	

Student Friendly Language:

I can use similar figures to find missing side lengths and missing angle measures.

I can use congruent figures to find missing side lengths and missing angle measures.

I can determine if two geometric figures are congruent or similar.

I can justify why two figures are congruent or similar using theorems from Geometry.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Triangle Congruence Theorems (SSS, SAS, ASA, AAS, HL) ● Corresponding Parts of Congruent Triangles are Congruent (CPCTC) ● Triangle Similarity Theorems (AA, SAS, SSS) ● Corresponding angles of similar triangles are equal in measure or congruent. ● Process of proof	Corresponding parts of congruent figures are equal in measure. Corresponding sides of similar figures are proportional in measure. Corresponding angles of similar figures are equal. Congruence and Similarity Theorems provide an efficient way to prove that corresponding parts are either congruent or similar. Congruent or similar figures and their relationships can be used to find missing sides or angles.	Justify congruence or similarity using appropriate geometric theorems. Solve for missing side or angle measures in congruent or similar figures. Analyze and solve real world problems involving congruent or similar figures.

Key Vocabulary:

parallel lines similar triangles proportionality transversal corresponding angles

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

A student can use congruent angles to find missing heights in problems involving shadows and heights. Similar triangles can be used to find the measures of things that are difficult to measure by hand.

Similar triangles can also be used in art to create perspective drawings.

A student can use congruent triangles to design a backsplash for a kitchen wall.

Resources/Project Ideas:
http://www.mathsinthecity.com/sites/snapshots-perspective

http://www.mathedpage.org/alg-2/perspective.pdf

SD Common Core State Standards Disaggregated Math Template

Domain:	Similarity, Right Triangles, and Trigonometry	**Cluster:**	Define trigonometric ratios and solve problems involving right triangles.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	9-12.F.TF.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

Student Friendly Language:

I can identify the side opposite to and adjacent to an acute angle in a right triangle.

I can write and simplify ratios using the sides of a right triangle.

I can compare side ratios of similar right triangles and identify if they are equivalent.

I can use the definition of sine, cosine, tangent, secant, cosecant, and cotangent to write those trigonometric ratios for a given triangle.

Know **(Factual)**	**Understand** **(Conceptual)** **The students will understand that:**	**Do** **(Procedural, Application, Extended Thinking)**
● similar triangles properties ● right triangle properties and parts ● trigonometric ratio (i.e. sine, cosine, tangent, secant, cosecant, cotangent) ● definition and purpose of trigonometry	The six trigonometric ratios only apply to right triangles. The trigonometric ratios of a specific acute angle are equivalent. All right triangles that contain the same angles measures are similar. Each trigonometric ratio has a unique definition.	Compare corresponding ratios of sides of similar right triangles. Write ratios to represent the sine, cosine, tangent , secant, cosecant, and cotangent of an acute angle in a right triangle.

Key Vocabulary:

trigonometric ratio sine cosine tangent secant cosecant cotangent

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

The student needs to develop an understanding of right angle trigonometry for use in future problem solving.

Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Similarity, Right Triangles, and Trigonometry	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.	9-12.G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles	9-12.G.SRT.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Student Friendly Language:
I can see the relationship between the sine and cosine of two complementary angles of a right triangle.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● trigonometric ratios ● Opposite, Adjacent, Hypotenuse ● right triangle parts and properties	Sine of an acute angle in a right triangle is equal to the cosine of the other acute angle.	Identify the opposite leg, adjacent leg, and hypotenuse with respect to an angle in a right triangle. Explain the relationship between sine and cosine of complementary angles of right triangles.

Key Vocabulary:
sine cosine complementary angles opposite leg adjacent leg hypotenuse right triangle
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?
The student needs to develop an understanding of right angle trigonometry for use in future problem solving. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

SD Common Core State Standards Disaggregated Math Template

Domain:	Similarity, Right Triangles, and Trigonometry	**Cluster:**	Define trigonometric ratios and solve problems involving right triangles	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.	G.SRT.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Student Friendly Language:

I can find the unknown parts of a right triangle using the sine/cosine/tangent ratios.

I can find the unknown angle measures of a right triangle using inverse sine, inverse cosine, and inverse tangent.

I can find the unknown parts of a right triangle using Pythagorean Theorem.

I can solve real world problems using trigonometric ratios and the Pythagorean Theorem.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• right triangles parts and properties • trigonometric ratios • inverse operations of trigonometric ratios • Pythagorean Theorem and its converse	Trigonometric ratios are used to find lengths of sides and angle measurements of a right triangle. When given two of the three sides of a right triangle the third side can be found by using the Pythagorean Theorem. When given one side and one acute angle of a right triangle, the other two sides can be found using trigonometric ratios. Given two sides of a triangle, both acute angles can be found using one of the inverse trigonometric ratios.	Solve for the unknown parts (angles and/or sides) of a right triangle by using the trigonometric ratios. Solve for the unknown side of a right triangle using the Pythagorean Theorem. Apply the use of trigonometric ratios to real-world situations. Apply the use of Pythagorean Theorem to real-world situations.

Key Vocabulary:

trigonometric ratios	sine ratio	cosine ratio	tangent ratio
inverse sine	inverse cosine	inverse tangent	Pythagorean Theorem

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"?

If a painter leans a ladder of a given length against a house, determine how far up the wall the ladder will reach by utilizing trigonometric ratios.

A 5-ft-tall woman stands 15-ft from a statue. She must look up at an angle of 60 degrees to see the top of the statue. How tall is the statue?

A student can find the height of various real world objects through the use of trigonometric ratios and indirect measurement.

SD Common Core State Standards Disaggregated Math Template

Domain:	Similarity, Right Triangles, and Trigonometry	**Cluster:**	Apply trigonometry to general triangles	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. 9-12 A-CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	9-12.G.SRT.9 Derive the formula $A = 1/2\ ab\ \text{Sin}(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.	9-12.G.SRT.10 10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.

Student Friendly Language:
I can construct the altitude of a triangle in order to model the formula Area = ½ ab ·sin(C). I can build the formula Area = ½ ab ·sin(C) using the area formula, substitution, and trigonometric ratios.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● area formula of a triangle ● substitution property of equality ● trigonometric ratios	They can create a new formula for the area of a triangle by manipulating information they already know.	Derive a new area formula for a triangle by manipulating an existing formula using algebraic properties and trigonometric ratios.

Key Vocabulary:				
derive	sine	altitude (auxiliary line)	vertex	perpendicular

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 skill of manipulating known formulas to work with the information you know can be used in future upper level math and engineering courses.

Carpenters and engineers can use this problem in remote locations where there is no technology.

Carpenters may need to find a new formula for finding the area of a triangle given certain measurements they have.

SD Common Core State Standards Disaggregated Math Template

Domain:	Similarity, Right Triangles, and Trigonometry	**Cluster:**	Apply trigonometry to general triangles	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
G.SRT.6-Define trigonometric ratios and solve problems involving right triangles. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	9-12.G.SRT.10-Prove the Laws of Sines and Cosines and use them to solve problems.	9-12.F.TF.8 Prove the Pythagorean identity $\sin_2(\theta) + \cos_2(\theta) = 1$ and use it to calculate trigonometric ratios.

Student Friendly Language:
I can prove the Law of Sines. I can prove the Law of Cosines. I can use Law of Sines and Cosines to solve problems.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Law of Sines • Law of Cosines • proper labeling techniques of sides and angles of a triangle • triangle conguence theorems	That it is appropriate to use Law of Sines in ASA and AAS cases. That it is appropriate to use Law of Cosines in SSS and SAS cases. That an ambiguous case for the Law of Sines when using SSA exists including an option of two solutions.	Derive the Law of Sines and use it to solve for the missing parts of a non-right triangle. Derive the Law of Cosines and use it to solve for the missing parts of a non-right triangle. Analyze a scenario where the Law of Sines produces two solutions.

Key Vocabulary:
Law of Sines Law of Cosines
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question "why do I have to learn this"?
The student can use the law of sines or the law of cosines in order to model problems dealing with construction sites. The student can use the law of sines or the law of cosines in order to model problems dealing with land survey problems.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Apply trigonometry to general triangles	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	9-12.G.SRT.11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).	(+)N.VM.9-12.4 (+) Add and subtract vectors. a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes. b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum. c. Understand vector subtraction v – w as v + (–w), where –w is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

Student Friendly Language:
I can apply the Law of Sines and the Law of Cosines. I can use given information to find unknown side lengths and angle measures in any triangle.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Law of Cosines • Law of Sines • properties of vectors	There is a relationship between trigonometric ratios and side lengths. The Law of Cosines and the Law of Sines can be used to find missing side lengths and angle measures in any triangle. Vectors can be used to create triangles to measure quantities such as magnitude and direction.	Understand the Law of Sines and apply it to solve for the missing parts of a non-right triangle. Understand the Law of Cosines and apply it to solve for the missing parts of a non-right triangle. Calculate unknown angle measurement/side lengths. Create triangles from vectors and use the triangles to solve problems.

Key Vocabulary:
Law of Sines Law of Cosines vector resultant forces component forces magnitude direction
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 GPS coordinates such as triangulation of cell phones and surveying roads. Determine the angle at which an object needs to be set in a construction project. Determine resultant vectors in physics like force and velocity.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometry	**Cluster:**	Understand and apply theorems about circles.	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
G.1.A	9-12.G.C.1. Prove that all circles are similar.	

Student Friendly Language:
I can recognize the parts of a circle. I can relate the parts of a circle. I can set up ratios for similar circles. I can find the measure of angles given parts of a circle.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• How to relate radius given circumference • How to calculate angles using tangents, secants and arc measures • How to find unknowns given several knowns • How to set up a ratio.	Circles can be shown to be similar by justifying properties and theorems.	Calculate the circumference of a circle, given the diameter or radius. Calculate angles inside and outside of a circle. Prove that circles are similar. Compare the ratios of the radius and circumference of multiple circles to determine similarity.

Key Vocabulary:				
Radius	Circumference	Ratio	Diameter	Arc
Chord	Tangent	secant	Arc Measure	

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 diameter of a water tower fitting into an area.
Relate a central angle to a pie chart.
Calculate the circumferences of a water tank given the diameter or radius.

SD Common Core State Standards Disaggregated Math Template

Domain:	Circles	**Cluster:**	Understand and apply theorems about circles.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.G.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 circumference and area of a circle. G.CO.1- Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment based on the undefined notions of point, line, distance along a line, and distance around a circular arc. G.C.1- Prove that all circles are similar.	9-12.G-C.2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*	

Student Friendly Language:

I can describe the relationship among inscribed angles, radii and chords within a circle.

I can identify and describe the relationship between central, inscribed and circumscribed angles.

I understand and can identify that inscribed angles on a diameter are right angles.

I understand and can identify a tangent line to a circle because it is perpendicular at the point the radius intersects the circle.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Be able to describe the relationships between inscribed angles, radii, and chords of a circle using the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angle	The measure of a central angle is twice the measure of an inscribed angle if they both intercept the same arc. A circumscribed angle and a central angle are supplementary. A tangent line to a circle intersects a circle at one point and is perpendicular to the radius at that point. The measure of a central angle is twice the measure of an inscribed angle if the both intercept the same arc. A circumscribed angle and a central angle are supplementary. A tangent line to a circle intersects a circle at one point and is perpendicular to the radius at that point.	Identify central angles, inscribed angles, circumscribed angles, tangent line and chords on a circle from a drawing. Construct and explain examples of central angles, inscribed angles, circumscribed angles, tangent line and chords on a circle.

Key Vocabulary:

Circle	inscribed angle	circumscribed angle	radii	diameter
chord	tangent line	central angle	supplementary angles	perpendicular

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"?

After completing this lesson, the students can each construct a dream catcher, which will include all of the angles mentioned in the standard. They can then relate what they have learned to what they construct.

SD Common Core State Standards Disaggregated Math Template

Domain:	Circles	**Cluster:**	Understand and apply theorems about circles	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
8.G.5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles 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	9-12.G-C.3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	

Student Friendly Language:

I can inscribe a circle in a triangle.

I can circumscribe a circle about a triangle.

I can prove properties of the angles of an inscribed quadrilateral.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	The angle bisectors of a triangle are concurrent at the incenter. The incenter of a circle is equidistant from all sides of the polygon. The perpendicular bisectors of the sides of a triangle are concurrent at the circumcenter. The circumcenter of a circle is equidistant from all vertices of the polygon.	construct angle bisectors. construct perpendicular bisectors. construct the inscribed circle of a triangle. construct the circumscribed circle about a triangle. prove that opposite angles of an inscribed quadrilateral are supplementary.

Key Vocabulary:

concurrent	incenter	incircle	inscribed	circumcenter
circumcircle	circumscribed	angle bisector	perpendicular bisector	subtends
opposite angles	supplementary	quadrilateral		

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

A person can use the circumcenter to find the ideal location for building a school that will serve three communities so as to be fair and reasonable for all.

Find the locations for placing cell phone towers in order to provide the best service for the most people.

SD Common Core State Standards Disaggregated Math Template

Domain:	Circles	**Cluster:**	Understand and apply theorems about circles	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
G.C.2- Identify and describe relationships among inscribed angles, radii and chords. Include ….the radius of a circle is perpendicular to the tangent where the radius intersects the circle. G.CO.2- Make formal geometric constructions with a variety of tools and methods (compass and straight edge, string, reflective devices, paper folding, dynamic geometric software, ect) 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.	(+) 9-12.G-C.4 (+) Construct a tangent line from a point outside a given circle to the circle.	

Student Friendly Language:
I can construct a tangent line if I am given a point outside a given circle.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• What a tangent line is • How to construct a tangent line using a point outside of the circle and the radius, as well as perpendicular lines	Two tangent lines to a circle can be constructed using a given point outside of the circle.	Students will construct a tangent line to a circle from a given point outside the circle using a variety of tools.

Key Vocabulary:					
tangent line	radius	circle	construction	point	center

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"?

Consider a radar tower that has a radar that reaches 20 miles in all directions as it sweeps around in a circle. A plane is exactly 30 miles east of the tower. Construct the flight path that will ensure that the plane can be detected by the radar tower only once (if it flies in a straight path by the tower).

SD Common Core State Standards Disaggregated Math Template

Domain:	Circles	**Cluster:**	Find arc lengths and areas of sectors of circles.	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.G.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. 9-12.G.C.2 Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.	9-12.G.C.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	

Student Friendly Language:

I can find the length of an intercepted arc.
I can convert angles from degree measure to radian measure.
I can convert angles from radian measure to degree measure.
I can determine the constant of proportionality between arc length and radius.
I can discover the formula for the area of a sector.
I can find the area of a sector

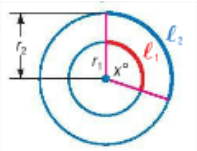
Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• formula for area of a circle • formula for circumference of a circle • arc length • area of sector • radian measure • constant of proportionality	Arc length is a fraction of the circumference of the circle, and that fraction is found by dividing the measure of the central angle by 360 degrees. 1 degree is equal to π/180 radians. Arc length is proportional to the radius of the circle and the constant of proportionality is the radian measure of the angle. Area of a sector is a fraction of the area of the circle and that fraction is found by dividing the measure of the central angle by 360 degrees.	Calculate the length of an intercepted arc. Demonstrate that the constant of proportionality between arc length and the radius of the circle is the radian measure of the central angle. Derive the formula for the area of a sector using similarity. Calculate the area of a sector.

Key Vocabulary:

arc length area of sector radian measure constant of proportionality Sector

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 window wiper of length 20 inches goes through an angle of 160^0 . Work out the area of window covered by the window wiper. The wiper is attached at the center of the bottom of the rear window, which is 54 inches wide and 26 inches high. Safety regulations state that 60% of the window should be cleared by the wiper. Does it meet the safety regulation?



2.a. Compare the measures of arc l1 and l2. Then compare the lengths of arc l1 and l2. What do these two comparisons suggest?
b. Use similarity transformations (dilations) to explain why the length of an arc l intercepted by a central angle of a circle is proportional to the circle's radius r. In other words, explain why .
c. Write expressions for the lengths of arcs l1 and l2. Use these expressions to identify the constant of proportionality k in l = kr.
d. The expressions that you wrote for k in part c gives the radian measure of an angle. Use it to find the radian measure of an angle measuring 90 degrees.

3. You recently bought a house in Sioux Falls and have decided to install surveillance cameras outside your house. Your land is 75 feet in width and the curb is 30 feet from the front of your house. The camera you are looking to buy covers 130 degrees and has a radius of 25 feet. Determine how much of your lawn will be covered by this one camera and where would you place it? Will you decide to purchase a second one and where would it be placed if you did?

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressing Geometric Properties with Equations	**Cluster:**	Translate between the geometric description and the equation for a conic section	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	9-12.G.GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.	9-12.F.TF.8 Prove the Pythagorean identity $\sin^2(x) + \cos^2(x) = 1$ and use it to calculate trigonometric ratios.

Student Friendly Language:
I can use/apply the Pythagorean Theorem to derive the equation of a circle. I can complete the square to find the center and radius of a circle, given the equation for a circle.

Know (Factual)	**Understand (Conceptual)** **The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Pythagorean Theorem • Standard Form of the Equation of a Circle • Completing the Square	Any point on a circle and the center of the circle form the endpoints of the hypotenuse of a right triangle OR a vertical or horizontal segment Completing the square within a circle equation allows the reader to determine the location of the center and the length of the radius. Pythagorean Theorem, the equation of a circle, and the distance formula are interrelated.	Explain how the Pythagorean Theorem can be used to derive the equation of a circle. Write the equation of a circle, given the center and radius. Complete the square within the equation of a circle in order to find the center and radius.

Key Vocabulary:			
circle	radius	center of circle	Pythagorean Theorem
completing the square	diameter	hypotenuse	

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"?
Useful when planning placements of underground sprinkler systems to minimize area not watered or area watered by more than one sprinkler

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressing Geometric Properties with Equations	**Cluster:**	Translate between the geometric description and the equation for a conic section	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
8.G.1 Understand congruence and similarity using physical models, transparencies, or geometry software. Verify experimentally the properties of rotations, reflections, and translations. Lines are taken to lines, and line segments to line segments of the same length F.BF.3 - Identify the effect on the graph by changing *f(x)* to induce various transformations (abbrev.) F.IF.8 - Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function	9-12.G.GPE.2 Derive the equation of a parabola given a focus and directrix	

Student Friendly Language:
I can figure out the formula of a parabola when I know the focus and directrix.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Characteristics of parabolas ● Role of focus and directrix	The distance from the focus to a point on the parabola and from that point on the parabola to the directrix are equal. The leading coefficient of the squared variable determines the parabola's shape and direction. The squared variable determines whether the parabola opens horizontally or vertically.	Describe the characteristics of a parabola given its equation. Derive the equation for a parabola given the focus and directrix.

Key Vocabulary:						
focus	directrix	derive	equation	parabola	distance	leading 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"?

Satellite television dish technology

Non-Invasive kidney stone surgery (using a parabolic mirror to focus sound and light waves)

Path of projectil

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressing Geometric Properties with Equations	**Cluster:**	Use coordinates to prove simple geometric theorems algebraically	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
9-12.G.GPE.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation. 9-12.G.MG.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder)	9-12.G.GPE.4 Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1,√3) lies on the circle centered at the origin and containing the point (0,2)*	

Student Friendly Language:

I can use the distance formula to find the distance between coordinates.

I can find the slope of a line connecting two coordinates.

I can determine if a point lies on a specific circle.

I can use coordinates to prove that a quadrilateral is, or is not, a parallelogram, rectangle, rhombus, square, or trapezoid.

I can use coordinates to prove a triangle's classification by its sides.

Know (Factual)	**Understand (Conceptual)** **The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Distance, midpoint, and slope formulas. ● Logical reasoning. ● Formal and informal proofs.	The distance formula can be used to prove geometric theorems involving quadrilaterals, circles, and other polygons. The slope formula can be used to prove geometric theorems involving quadrilaterals, circles, and other polygons. The midpoint formula can be applied to prove geometric theorems about quadrilaterals. A conclusion can be developed based on given facts.	Apply the distance, midpoint and slope formulas to coordinates. Use logical reasoning to prove or disprove geometric theorems. Construct formal and informal proofs of geometric theorems.

Key Vocabulary:

Distance Formula	Slope Formula	Midpoint Formula	Logical Reasoning
Formal Proof	Informal Proof	Coordinate Proof	Polygons
Circles	Coordinates	Origin	Coordinate Plane

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"?

To determine if a building foundation is square, prove that the diagonals are congruent.

To determine if a plant will receive water given the location of the sprinkler and the radius of coverage.

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressing Geometric Properties with Equations	**Cluster:**	Use coordinates to prove simple geometric theorems algebraically	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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 the two moving objects has greater speed.*	G.GPE.5: Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g. find the equation of a line parallel or perpendicular to a given line that passes through a given point).	

Student Friendly Language:

I can identify that if lines are parallel, their slopes are equal.

I can identify that if lines are perpendicular, their slopes are opposite reciprocal.

I can use the slope to find an equation of a line that goes through a given point.

I can solve a geometric problem using slope of a line.

Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
• properties of parallel lines • properties of slope and rate of change • properties of perpendicular lines • point-slope and/or slope-intercept form to find an equation	An equation of a line (parallel or perpendicular) that is usable to solve your geometric problem can be produced.	Show parallel lines have the same slope. Show parallel lines increase at the same rate of change. Show perpendicular lines have opposite reciprocal slopes. Show that perpendicular line intersect at a right angle. Construct an equation of a line that is parallel or perpendicular to a given line.

Key Vocabulary:

slope	parallel lines	perpendicular lines	point-slope
slope-intercept	opposite reciprocal	rate of change	

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

Students need to be able to construct a geometric shape such as a rectangle because it is the foundation of many structures which you build. If walls don't meet at a right angle and/or the floor and ceiling are not parallel, they will not pass building inspection.

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressing Geometric Properties with Equations	**Cluster:**	Use coordinates to prove simple geometric theorems algebraically	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
6.G.3 Draw polygons in the coordinate plane given coordinates for the vertices... 8.G Understand congruence and similarity using physical models, transparencies, or geometry software.	9-12.G.GPE.6 Find the point on a directed segment between two given points that partitions the segment in a given ratio.	

Student Friendly Language:
I can determine the location (coordinate point) of a point that is a fraction/part of the way between 2 points on a direct route (segment).

Know (Factual)	**Understand (Conceptual) "I want students to understand THAT..."**	**Do (Procedural, Application, Extended Thinking)**
• Points on a directed segment	This formula: $[x_1+n(x_2-x_1), y_1+n(y_2-y_1)]$ where $n \leq 1$ (given partition or ratio) is used to find the corresponding coordinates.	Determine the coordinates of a point of a given partition on a directed segment.

Key Vocabulary:
directed segment ratio 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"?
Determine the coordinates of your location when you have traveled a quarter of the distance between home and school, given your path is a straight line. An airplane is flying from a given latitude and longitude to a given latitude and longitude. What will the latitude and longitude be a quarter of the way through the flight?

SD Common Core State Standards Disaggregated Math Template

Domain:	Expressing Geometric Properties with Equations	**Cluster:**	Use coordinates to prove simple geometric theorems algebraically.	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
8.G.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system	9-12.G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. e.g. using the distance formula.	

Student Friendly Language:
I can use the distance formula to find the side lengths of a polygon. I can find the perimeter and areas of polygons.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Distance Formula ● Perimeter of a polygon ● Areas of polygons ● Units for labeling areas and perimeters	They can use the distance formula to compute the side lengths of polygons. They can then use the side lengths to calculate areas and perimeters. There are appropriate labels for the areas and perimeters.	Use the distance formula to find the length of sides of a polygon. Choose the appropriate formula for perimeter or area of a given polygon. Calculate areas and perimeters of polygons. Use appropriate labels for the areas and perimeters.

Key Vocabulary:			
perimeter	area	distance formula	Pythagorean Theorem
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?			
Determine the amount of fencing needed for a pasture. Determine the amount of seed needed to plant a field. Find the distance traveled between three cities given the latitude and longitude.			

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometric Measurement and Dimension	**Cluster:**	Explain volume formulas and use them to solve problems	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.G.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.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. 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.	9-12.G.GMD.2.(+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

Student Friendly Language:

I can decompose volume formulas into area formulas using cross-sections.

I can recognize cross-sections of solids as two-dimensional shapes.

I can give an informal argument for volume formulas of cylinders, pyramids, and cones.

I can give an informal argument for circumference and area formulas for circles.

I can use Cavalieri's Principle, dissection arguments, and informal limit arguments.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Cavalieri's Principle • Dissection and Informal limit arguments can be used to justify circle formulas for circumference and area. • Informal arguments can be used to justify the volume formulas for cylinders, pyramids and cones.	Two-dimensional relationships are connected to the properties of three-dimensional figures. Cavalieri's Principle, dissection arguments, and limits can be used to informally justify volume formulas. Relationships exist between volumes of pyramids and prisms and between volumes of cones and cylinders.	Demonstrate Cavalieri's Principle concretely. (Ex: Using a deck of cards, stack of pennies, or stack of CDs). Give an informal argument for circumference and area formulas for circles. Give an informal argument for volume formulas of cylinders, pyramids, and cones.

Key Vocabulary:

Cavalieri's Principle	dissection arguments	informal limit arguments	two-dimensional figures
three-dimensional figures	circumference	area	volume
cylinder	pyramid	cone	

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"?

Volume formulas are used in the world to compare capacities of different types of storage containers and finding the best type for the needs of a company or product.

Compound volume formulas activity: Glasses
http://map.mathshell.org/materials/lessons.php

Evaluating Statements about Enlargements of Objects (2D and 3D) Activity
http://map.mathshell.org/materials/download.php?fileid=678

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometric Measurement and Dimension	Cluster:	Explain volume formulas and use them to solve problems	Grade level:	9 - 12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
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.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	

Student Friendly Language:

I can read and use formulas for geometric figures.

I can find the volume of cylinders, pyramids, cones, and spheres.

I can use the volume of a three dimensional figure to solve real world problems.

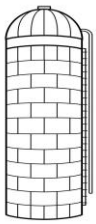
Know (Factual)	Understand (Conceptual) The students will understand that:	Do (Procedural, Application, Extended Thinking)
● Geometric shapes: cylinders, pyramids, cones, spheres ● How to calculate volume for these geometric shapes ● How to use formulas to solve problems. ● Correct units for volume measurement.	Volume can represent anything that takes up space. Volume can be used to solve many types of real world problems.	Identify these geometric shapes: cylinders, pyramids, cones, and spheres. Calculate volume for cylinders, pyramids, cones and spheres. Use formulas to solve problems involving three-dimensional figures. Apply volume to real world problems.

Key Vocabulary:

volume geometric shapes cylinders pyramids cones spheres

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"?

If you have a silo with a radius of 15 feet and a height of 50 feet, find the volume. If feed is dropped into the silo at 50 cubic feet per minute, how long will it take to fill the entire silo (including the hemisphere on top)?



Does your answer make sense? Explain.

SD Common Core State Standards Disaggregated Math Template

Domain:	Geometric Measurement and Dimension	**Cluster:**	Visualize the relation between two-dimensional and three-dimensional objects.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.G.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.	9-12.G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.	9-12.GMD.2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

Student Friendly Language:

I can take a three-dimensional object and slice it at various angles and predict the shape that would be created.

I can rotate a two--dimensional figure and predict the three-dimensional shape that would be created.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
● Nets of three-dimensional figures. ● Cross-sections of three-dimensional shapes are two-dimensional. ● Rotations of two-dimensional shapes are three-dimensional. ● Geometric software can be used for modeling.	Two-dimensional shapes are generated from cross-sections of three-dimensional objects. Three-dimensional objects are created from rotations of two-dimensional shapes.	Draw a net for a three-dimensional figure. Sketch cross-sections of a given three-dimensional shape. Sketch a three-dimensional shape formed by rotation of a given cross-section. Use geometric simulation software to model figures and create cross-sectional views.

Key Vocabulary:

three dimensional (3-D) shape two-dimensional (2-D) cross-section axis of rotation revolution net polyhedra/polyhedron conic section

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"?

Engineering of manufactured parts and their CAD drawings.

Predict all of the possible 2D shapes that can be created by slicing a cube, cylinder, or cone with a plane.

Given a 2-D shape, create a corresponding 3-D shape: Determine and describe a reasonable use (packaging, toy, etc.) for the shape you create.

Given a 2-dimensional photo (architecture, vehicle, etc.), identify the 3-D shapes represented.

SD Common Core State Standards Disaggregated Math Template

Domain:	Modeling with Geometry	**Cluster:**	Apply geometric concepts in modeling situations	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
CC.8.G.9 Solve real-world and mathematical problems involving volume of cylinders, cones and spheres. Know the formulas for the volume of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	G.MG.1 Use Geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).*	G-MG.2 Apply concepts based on area and volume in modeling situations (e.g. persons per square mile, BTU per cubic foot) G-MG-3 Apply geometric methods to solve design problems (e.g. designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios.)

Student Friendly Language:
I can recognize a geometric shape in the real world (ie trash cans, tree trunks, buildings). I can create and solve a real life problem involving geometric shapes. I can find the volume and surface area of a sphere, cylinder, rectangular solid, cone, and pyramid.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Use Geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* • Incorporate scale and proportion when modeling life-sized objects	Three-Dimensional geometric shapes occur commonly in nature and as man-made objects. Formulas can be applied to calculate surface area and volume.	Recognize the geometric shape that corresponds to a real object.

Key Vocabulary:
Pi surface area lateral area volume
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 volume of space inside a freezer. Determine board feet in a stand of timber. Calculate area of walls to determine amount of paint needed to paint a room.

SD Common Core State Standards Disaggregated Math Template

Domain:	Modeling with Geometry	**Cluster:**	Apply geometric concepts in modeling situations.	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
7.G.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.	9-12.G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).	

Student Friendly Language:

I can identify the correct labels of density problems, area, and volume.

I can set up fractions(ratios) to solve density problems.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● area and volume labels ● methods used when calculating density ● area and volume formulas ● fractions ratios and or proportions ● comparing models to real-sized objects	Density is always expressed as a fraction. Density is a comparison of two things and/or a rate.	Build/construct the different volume/area formulas for shapes/figures. Explain and apply how to find density for different types of information

Key Vocabulary:

density area volume units squared units cubed
all of the shapes/figures (square, circle, cube, etc.) formulas dimensional/unit analysis

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 can calculate the density of one material multiple times. However with each calculation, the material must be a different size (take up more volume). After they have done this, the students can compare and note that the density should be the same for that material, no matter the size.

SD Common Core State Standards Disaggregated Math Template

Domain:	Modeling with Geometry	**Cluster:**	Apply geometric concepts in modeling situations.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.G.4 - 6 Solve real life and mathematical problems involving angle measure, area, surface area, and volume. 8.G.6 - 8 Understand and apply the Pythagorean Theorem 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.MG.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typography grid systems based on ratios).*	

Student Friendly Language:

I can use geometric concepts (area, surface area, volume, angle measure, etc.) to create a model of a real life situation.

I can use simulation software and modeling software to explore which model best describes a set of data or situation.

Know (Factual)	**Understand (Conceptual) The students will understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Formulas pertaining to geometric figures ● Properties of lines and shapes ● Applying scale models to real-size objects ● Use models to determine which possible structure designs would be best suited to use for life-size structures	Design problems can be solved using geometric concepts. 3-Dimensional situations can be represented using a 2-Dimensional representation.	Determine which geometric concepts/figures best model a given situation. Apply an array of formulas to a determine the appropriate geometric solutions. Design a model of a real-life object using geometric figures.

Key Vocabulary:

area surface area volume angle measure Pythagorean Theorem geometric figures formulas parallel perpendicular scale angle classifications scale 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"?

Designing a deer stand

Designing a grain elevator

Design a pool with a specific volume

Design a box to minimize the cost of materials.

Design the layout of yard. (Place a garden to receive ample sunlight...)

SD Common Core State Standards Disaggregated Math Template

Domain:	Conditional Probability and the Rules of probability	**Cluster:**	Understand independence and conditional probability and use them to interpret data.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.SP.8.b Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.	S.CP.1 Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").	S.CP.2 Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

Student Friendly Language:
I can define a sample space and events within the sample space. I can identify subsets for a sample space given defined events, including unions, intersections and complements of events.

Know (Factual)	**Understand (Conceptual) I want students to understand that:**	**Do (Procedural, Application, Extended Thinking)**
● A sample space is the set of all outcomes for a situation. ● An event is a set of outcomes (a subset of the sample space).	Probable outcomes of an event can be displayed using tree diagrams, Venn diagrams, or contingency tables. Sample space can include subsets formed by the intersection, union and complements of an event. Union is described as a compound statement using "or". Intersection is described as a compound statement using "and". If p is the probability that Event P will occur, then the complement of p is "not p", or 1 - p.	Describe events as subsets of a sample space. Organize outcomes of an event in tree diagrams, Venn diagrams, or contingency tables. Analyze data and events to determine unions, intersections and/or complements from sample sets.

Key Vocabulary:
and or subsets not union intersection notation ree diagram Venn diagram sample space events, outcomes complements contingency table
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: Given a sample space of all students in a school, create a Venn diagram, tree diagram or contingency showing that some students play basketball, some play volleyball, and some play both.

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics & Probability	**Cluster:**	Understand independence and conditional probability and use them to interpret data	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.SP.8: Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation S.CP.1: Understand independence and conditional probability and use them to interpret data	9-12.S.CP.2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	9.12.S.CP.3 Understand the conditional probability of A given B as P(A and B)/P(B),and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

Student Friendly Language:

I can find the probability of two (or more) independent events.

I can distinguish between independent and dependent events.

I can determine if two events are independent when given the probability of A, the probability of B, and the probability of A and B.

Know (Factual)	**Understand (Conceptual) I want students to understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Two events are independent if the outcome of one does not affect the outcome of the other. ● Two events are dependent if the outcome of one affects the outcome of the other.	The probability of two independent events is the product of each individual probability.	Calculate the probability of two (or more) independent events. Determine if two events are independent when given the probability of A, the probability of B, and the probability of A and B.

Key Vocabulary:

independent events dependent events

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: If your flight to Chicago is on time 90% of the time and your flight on to Denver is on time 75% of the time, determine the probability that both flights are on time.

Example: A nationwide survey showed that 65% of all children in the United States dislike eating vegetables. If 4 children are chosen at random, what is the probability that all 4 dislike eating vegetables?

Example: The flight to Dallas is on time 85% of the time and the flight to San Francisco is on time 75% of the time. If the probability that you arrive on time in Dallas and San Francisco is 80%, are the flights independent?

SD Common Core State Standards Disaggregated Math Template

Domain:	Conditional Probability and the Rules of Probability	**Cluster:**	Understand independence and conditional probability and use them to interpret data.	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
7.SP.8 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.	9-12.S.CP.3 Understand the conditional probability of A given B as P(A and B)/P(B),and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.	9-12.S.CP.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*

Student Friendly Language:

I can determine if an event is independent or dependent of another event.

I can calculate the conditional probability of independent events.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
• The conditional probability of A given B is P(A|B)=P(A and B)/P(B)	The probability of A given B is the same as the probability of A, if A and B are independent. The probability of B given A is the same as the probability of B, if A and B are independent. Conditional probability deals with independent and dependent events.	Determine if two events are independent or dependent. Calculate the conditional probability of an event.

Key Vocabulary:

conditional probability independent events dependent events

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”?

Draw a card from a single deck. The probability that the card will be a Jack is 4/52. But suppose you get a glimpse of the card, enough to know that it is a face-card. Now things are different. You have more information about the card. The probability that the card is a Jack "*given that it is a face-card*" is called a conditional probability.
We know there are only 12 face-cards (4 Jacks, 4 Queens and 4 Kings) in a single deck, so the probability that the card is a Jack "*given that it is a face-card* now becomes 4/12, or 1/3.
In general terms, the "*conditional probability*" P(A|B) is the probability that A occurs, given that B has occurred and is formally defined as:

"Given that you have been dealt an Ace as your first card, what is the probability of being dealt a blackjack?" Using the formula for condtional probability, we get:
P(Blackjack|Ace has been dealt) = P(Blackjack and Ace has been dealt)/P(Ace has been dealt)
For independent events, P(A and B) = P(A) * P(B). The probability of receiving a blackjack is (4/52)*(16/51) + (16/52)(4/51). But because we are specifying that the Ace must come first for our Blackjack, we must not include any blackjacks where the 10-valued card comes first. Therefore, the blackjack is made up of an Ace first and only then a 10-value card, so we can say that P(Blackjack and Ace has been dealt first) = (4/52 * 16/51). Therefore, P(Blackjack|Ace has been dealt first)= P(Blackjack and Ace has been dealt first)/P(Ace has been dealt first) = (4/52 * 16/51)/(4/52) = 16/51.

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	**Cluster:**	Understand independence and conditional probability and use them to interpret data.	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
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?*	9-12.S.CP.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*	9-12.S.CP.5 Understand independence and conditional probability and use them to interpret data. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*

Student Friendly Language:

I can explain what bivariate data is.

I can collect data and make a two-way frequency table of that data.

I can determine if the data is independent or dependent.

I can estimate conditional probability from that data.

Know (Factual)	**Understand (Conceptual) I want students to understand that:**	**Do (Procedural, Application, Extended Thinking)**
● Bivariate data can be displayed in a two-way frequency table.	Bivariate data is the analysis of two variables simultaneously. Bivariate data makes comparisons, shows relationships. Bivariate data has two-way frequency tables where one variable is contingent on the values of the other variable. (independent vs dependent)	Collect data and display in a two-way frequency table of that data. Interpret the data to determine if it is independent or dependent. Determine conditional probability from the data.

Key Vocabulary:

bivariate data	two-way frequency table	independent events
dependent events	conditional probability	sample space

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"?

Collect data from a random sample of students in your school on their favorite sport among basketball, volleyball, and football. Estimate the probability that a randomly selected student from your school will favor volleyball given that the student is in twelfth grade. Do the same for other sports and compare the results.

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	**Cluster:**	Understand independence and conditional probability and use them to interpret data.	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
9-12.S.CP.4 Understand independence and conditional probability and use them to interpret data. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.*	9-12.S.CP.5 Understand independence and conditional probability and use them to interpret data. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*	9-12.S.CP.6 Use the rules of probability to compute probabilities of compound events in a uniform probability model. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.*

Student Friendly Language:

I can look at bivariate data and determine if the two variables are independent.

I can describe examples that involve independent events.

I can describe examples that involve conditional probability.

I can recognize everyday situations as events that are independent and describe their conditional probability.

Know (Factual)	**Understand (Conceptual)** **I want students to understand that:**	**Do (Procedural, Application, Extended Thinking)**
• What independent events are. • What conditional probability is and how to calculate it.	Conditional probability occurs in many real life situations.	Identify real world situations in which conditional probability can be found. Find a real world situation involving conditional probability and make conjectures based on the situation. Calculate conditional probability given a real world situation.

Key Vocabulary:

conditional probability independence

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

Determine the probability that a current Major League Baseball player has a career batting average over .300 given that they currently play in the American League. Then determine the probability that a current player has a career batting average over .300 given that they currently play in the National League. Compare the results and make a conjecture about which league has better hitters.

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	**Cluster:**	Use the rules of probability to compute probabilities of compound events in a uniform probability model	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.S.CP.5 Understand independence and conditional probability and use them to interpret data. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*	9-12.S.CP.6 Use the rules of probability to compute probabilities of compound events in a uniform probability model. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.*	9-12.S.CP.7 Use the rules of probability to compute probabilities of compound events in a uniform probability model. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model.*

Student Friendly Language:

I can use probability rules to calculate a probability which has more than one event affecting the results.

I can use the information in a word problem to calculate the probability of an event.

I can recognize situations that have compound events and calculate probabilities of events determined by the situation.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
● How to find probability of compound events in a uniform probability distribution.	Compound events can affect each other. To calculate compound probability, the individual events probabilities are multiplied. Conditional probability is dependent on other outcomes.	Compute probabilities of compound events and interpret the results in context of the situation. Determine the type of probability that exists in a real world situation.

Key Vocabulary:

compound events conditional probability uniform probability 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"?

Determine the probability of rolling a Yahtzee.

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	Cluster:	Use the rules of probability to compute probabilities of compound events in a uniform probability model	Grade level:	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.S.CP.6 Use the rules of probability to compute probabilities of compound events in a uniform probability model. Find the conditional probability of A given B as the fraction of B;s outcomes that also belong to A, and interpret the answer in terms of the model.	9-12.S.CP.7 Use the rules of probability to compute probabilities of compound events in a uniform probability model. Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model.	9-12.S.CP.8 Use the rules of probability to compute probabilities of compound events in a uniform probability model. Apply the general Multiplication Rule in a uniform probability model, P(A or B) = [P(A)]x[P(B\A)] = {P(B)]x[P(A\B)], and interpret the answer in terms of the model.

Student Friendly Language:

I can apply the Addition Rule of probability for compound events in a uniform probability model.

I can interpret the answer of the addition rule in terms of my model.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
• How to determine if two events are mutually exclusive or inclusive.	The addition rule is used to find the probability of inclusive events. Compound events can be mutually exclusive or inclusive, but not both.	Determine if compound events are mutually exclusive or inclusive. Calculate the probability of compound events that are inclusive using the addition rule and interpret the result in context of the situation.

Key Vocabulary:

compound events
mutually exclusive events
inclusive events
addition rule of probability

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

Determine the probability of selecting a student at random at an assembly that is female or a tenth grader.

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	**Cluster:**	Use the rules of probability to compute probabilities of compound events in a uniform probability model	**Grade level:**	9-12

Correlating Standard in Previous Year	Number Sequence & Standard	Correlating Standard in Following Year
9-12.S.CP.7 Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model.	9-12.S.CP.8 (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.	9-12.S.CP.9 Use permutations and combinations to compute probabilities of compound events and solve problems

Student Friendly Language:

I can apply the multiplication rule of probability.

I can interpret the answer to the multiplication rule in terms of the model.

Know (Factual)	Understand (Conceptual) I want students to understand that:	Do (Procedural, Application, Extended Thinking)
• How to determine when you need to find the probability of the intersection of two events.	The multiplication rule is used to find the probability of the intersection of two events.	Calculate the probability of the intersection of two events using the multiplication rule and interpret the result in context of the situation.

Key Vocabulary:

intersection
multiplication rule of probability

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

A sack contains 4 blue marbles, 3 red marbles and 6 green marbles. You are to select two marbles at random out of the sack and you will not replace the first marble before you select the second marble. Determine the probability of selecting first a red marble and then a green marble.

SD Common Core State Standards Disaggregated Math Template

Domain:	Statistics and Probability	**Cluster:**	Use the rules of probability to compute probabilities of compound events in a uniform probability model	**Grade level:**	9-12

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
S.CP.8 (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model.	S.CP.9 (+) Use the rules of probability to compute probabilities of compound events in a uniform probability model. Use permutations and combinations to compute probabilities of compound events and solve problems.	

Student Friendly Language:
I can use permutations to compute the probability of compound events and solve problems. I can use combinations to compute the probability of compound events and solve problems.

Know (Factual)	**Understand (Conceptual) I want students to understand that:**	**Do (Procedural, Application, Extended Thinking)**
• Permutations are an ordered list of objects • Combinations are a group of objects.	Permutations and combinations can be used to find probability in some real world situations. There is a difference between permutations and combinations.	Determine if permutations or combinations should be used to find the probability of a given situation. Use permutations to compute probabilities of compound events and solve real world problems. Use combinations to compute probabilities of compound events and solve real world problems.

Key Vocabulary:
permutations combinations ordered list
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 probability of selecting the top three finishers, in any order, in a horse race with eight horses. Find the probability of correctly selecting the 1st, 2nd and 3rd place finishers in a horse race with eight horses.

SD Common Core State Standards Disaggregated Math Template

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

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
S.MD.5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.* b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident*	S.MD.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	S.MD.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

Student Friendly Language:
I can use a random number generator to make fair decisions. I can draw lots to make a decision

Know (Factual)	**Understand (Conceptual)**	**Do (Procedural, Application, Extended Thinking)**
● Random number ● ·Lots ● ·Probability ● ·Theoretical Probability ● ·Experimental Probability	A random number generator can generate impartial values Drawing lots or random numbers ensures the fairness or impartially of a decision	Use a graphing calculator to generate random numbers Use lots to make impartial decisions Determine experimental probability of an event and compare it to the theoretical

Key Vocabulary:				
Random number	Lots	Probability	Theoretical Probability	Experimental Probability

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

Use a random number generator to assign values to students to allow for an unbiased decision on selection to a committee
Determine the experimental probability of a game to see if it is fair.

SD Common Core State Standards Disaggregated Math Template

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

Correlating Standard in Previous Year	**Number Sequence & Standard**	**Correlating Standard in Following Year**
S.MD.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	S.MD.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	NA.

Student Friendly Language:
I can use probability to check decisions made about product testing in manufacturing, sports decisions, and medical tests.

Know (Factual)	**Understand (Conceptual)**	**Do (Procedural, Application, Extended Thinking)**
• Probability • Random numbers • Fair (impartial) decisions • Contingency table • Uncertainty	Multiple representations may be used to solve probability problems. . Knowledge of probability can assist them in everyday decision making that involves uncertainty. . Contingency tables can be used in decision making.	Analyze a situation and determine the various outcomes Use probability to assignment values to the various outcomes

Key Vocabulary:
Contingency table Outcome probability
Relevance and Applications: How might the grade level expectation be applied at home, on the job or in a real-world, relevant context? Include at least one example stem for the conversation with students to answer the question “why do I have to learn this”?
The student will be able to apply the decision-making process to analyze whether to buy a power ball ticket when the prize is very high. Consider the role that probabilities play in health care decisions, such as deciding between having eye surgery and wearing glasses