South Dakota Mathematics

Geometry

Right Triangles

Special Right Triangles and Pythagorean Theorem

1. Apply the properties of special right triangles (30°–60°–90° and 45°–45°–90°) to solve real-world and mathematical problems G.RT.1
2. Prove and apply the Pythagorean Theorem and its converse. G.RT.2

Trigonometry Ratios

3. Define that side ratios in right triangles are related to the angles in the triangle, leading to definitions of trigonometric ratios (sine, cosine, and tangent) for acute angles. G.RT.3
4. Explain the relationship between the sine and cosine of complementary angles and use them to solve problems. G.RT.4
5. Use the definition of the trigonometric ratios (sine, cosine, tangent, secant, cosecant, cotangent) as ratios of side in a right triangle to solve problems about lengths of sides and measurements of angles. G.RT.5
6. Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles. G.RT.6

Circles

Circle Relationships

1. Recognize and apply relationships between angles, radii, chords, tangents, and secants, including: the relationship between central, inscribed, and circumscribed angles; that inscribed angles intersecting a diameter are right angles; and the radius of a circle intersecting a tangent line at the point of tangency forms a right angle G.C.1
2. Explain how arc length relates to the whole circle using proportional reasoning and visual models to justify solutions. G.C.2
3. Use the proportional relationship between the measure of the area of a sector of a circle and the area of the circle to solve problems. G.C.3

Equations of Circles

4. Write the equation of a circle, given the radius and center, where the center is at the origin or another point. G.C.4
5. Identify the center and radius of a circle, given the equation of a circle, where the center is at the origin or another point. G.C.5

Geometric Figures

Two-Dimensional

1. Understand and apply the fundamental geometric elements—points, lines, line segments, rays, planes, angles, and circles—by describing their properties and using them to model and solve real-world and mathematical problems G.GF.1
2. Apply and prove theorems about triangles including: the isosceles triangle Theorem and its converse; the triangle midsegment theorem; the proportionality theorem; the triangle inequality theorem and its converse. G.GF.2
3. Apply and prove theorems about quadrilaterals G.GF.3
4. Apply theorems about polygons including interior angle sum and exterior angle theorems G.GF.4
5. Construct an equilateral triangle, square, and a regular hexagon. G.GF.5

Three-Dimensional

6. Find the volume and surface area of complex three-dimensional figures composed of prisms, pyramids, cones, cylinders, and spheres. G.GF.6
7. Give an informal argument for the formulas for the volume of a cylinder, pyramid, sphere, and cone. Use dissection arguments, and informal limit arguments G.GF.7
8. Identify the three-dimensional figure generated by rotating a two-dimensional figure about a fixed axis. G.GF.8
9. Use three-dimensional geometric figures and their measures to model real-world objects and solve problems. G.GF.9
10. Identify two-dimensional cross sections of three-dimensional objects. G.GF.10

Geometric Probability

11. Calculate probabilities as a proportion of area in a geometric context G.GF.11

Lines and Angles

Define and Construct

1. Make geometric constructions with a variety of tools and methods, including: congruent segments and angles; segment and angle bisectors; perpendicular lines; and the perpendicular bisector of a line segment. G.LA.1

Coordinate Geometry

2. Determine the point that cuts a line segment into a specified ratio on a number line and a coordinate plane, including finding the midpoint. G.LA.2
3. Derive the distance and midpoint formulas and use the formulas, including the slope formula, to verify geometric relationships on a coordinate plane. G.LA.3
4. Calculate the perimeter of polygons when given the vertices, including using the distance formula. G.LA.4
5. Use coordinates to prove geometric relationships algebraically G.LA.5

Parallel and Perpendicular Lines

6. Prove and apply slope criteria of parallel and perpendicular lines to solve problems. G.LA.6
7. Prove and apply theorems about lines and angles including vertical angles, angles formed by parallel lines cut by a transversal, and points on a perpendicular bisector G.LA.7
8. Write an equation of a line that is parallel or perpendicular to a given line and passing through a given point. G.LA.8

Transformations

Coordinate Plane

1. Describe rotations, reflections, and translations as functions that take points in the coordinate plane as inputs and give other points as outputs; write in prime notation. G.T.1
2. Compare transformations that preserve distance and angle (rotation, reflections, and translations) to those that do not (dilations) to develop definitions of congruence and similarity G.T.2
3. Given a rectangle, parallelogram, trapezoid, or a regular polygon, describe the rotations and/or reflections that map the figure onto itself. G.T.3
4. Identify whether a figure has reflectional (line) symmetry. If so, identify the lines of symmetry and determine how many lines of symmetry the given figure has. GT.4
5. Identify whether a figure has rotational symmetry. If so, state the angle of rotational symmetry, and the number of times the figure can be rotated onto itself (between 0° and 360°). GT.5

Plane

6. Given two congruent figures, identify the sequence of transformations that maps one figure to another. G.T.6
7. Apply understanding of angles, circles, perpendicular lines, parallel lines, and line segments to develop definitions for rotations, reflections, and translations. G.T.7

Similarity and Congruency

Similarity

1. Given two figures, apply the definition of similarity in terms of a dilation to identify similar figures, proportional sides, and corresponding congruent angles and finding and using the scale factor of the dilation that maps one figure to the other. G.SC.1
2. Determine whether figures are similar, using the definition of similarity and using similarity transformations. G.SC.2
3. Verify experimentally and apply the properties of dilations as determined by a center and a scale factor G.SC.3
4. Develop, apply and prove the criteria of similarity for triangles (AA~, SAS~, and SSS~) to solve problems and prove geometric relationships. G.SC.4
5. Use transformations to prove all circles are similar G.SC.5

Triangle Congruency

6. Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. G.SC.6
7. Explain, using rigid motion transformations, why two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. G.SC.7
8. Develop and apply criteria for triangle congruence (ASA, SAS, AAS, SSS, HL) and similarity to solve problems and prove relationships within triangles and other geometric figures. G.SC.8

Statistics and Probability

Conditional and Joint Probability

1. Describe events as subsets of a sample space or as unions, intersections, or complements of other events. G.SP.1
2. Determine whether two events A and B are independent. G.SP.2
3. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the result, including everyday language and situations. Construct and interpret two-way frequency tables to represent data and use them to determine conditional probabilities and assess independence of events. G.SP.3
4. Apply the Addition Rule, $p(A \text{ or } B)$, and interpret the result. G.SP.4
5. Apply the general Multiplication Rule, $p(A \text{and } B)$, and interpret the result G.SP.5