

Got Math?

Southern Nevada
Regional Professional
Development Program

NACS MINI-SERIES
HS #6B

NEVADA ACADEMIC
CONTENT STANDARDS



Based on Common Core

A Newsletter from the Secondary Mathematics Team www.rpdp.net

Geometry - Nevada Academic Content Standards (High School)*

Geometry is one of the six conceptual categories in the Nevada Academic Content Standards.

Congruence G-CO

Experiment with transformations in the plane

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.
2. **Represent transformations** in the plane using, 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).
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, **describe the rotations and reflections** that carry it onto itself.
4. **Develop definitions** of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
5. Given a geometric figure and a rotation, reflection, or translation, **draw the transformed figure** using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

Understand congruence in terms of rigid motions

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.
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.
8. **Explain how** the criteria for triangle congruence (**ASA, SAS, and SSS**) follow from the definition of congruence in terms of rigid motions.

Prove geometric theorems

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.
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.
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.

Make geometric constructions

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.
13. **Construct** an equilateral triangle, a square, and a regular hexagon inscribed in a circle

Similarity, Right Triangles, and Trigonometry G-SRT

Understand similarity in terms of similarity transformations

1. **Verify** experimentally the properties of dilations given by a center and a scale factor:
 - a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
 - b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
2. **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.
3. **Use the properties of similarity transformations** to establish the AA criterion for two triangles to be similar.

Prove theorems involving similarity

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.
5. **Use congruence and similarity criteria** for triangles to solve problems and to prove relationships in geometric figures.

Define trigonometric ratios and solve problems involving right triangles

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.



Math Resources

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Geometry - Nevada Academic Content Standards (HS)* (Continued)

7. **Explain and use** the relationship between the sine and cosine of complementary angles.
8. **Use trigonometric ratios** and the Pythagorean Theorem to solve right triangles in applied problems. ★

Apply trigonometry to general triangles

9. (+) **Derive the formula** $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
10. (+) **Prove the Laws of Sines and Cosines** and use them to solve problems.
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).

Circles G-C

Understand and apply theorems about circles

1. **Prove that all circles** are similar.
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. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
4. (+) **Construct a tangent line** from a point outside a given circle to the circle.

Find arc lengths and areas of sectors of circles

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.

Expressing Geometric Properties with Equations G-GPE

Translate between the geometric description and the equation for a conic section

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.
2. **Derive the equation of a parabola** given a focus and directrix.
3. (+) **Derive the equations of ellipses and hyperbolas** given the foci, using the fact that the sum or difference of distances from the foci is constant.

Use coordinates to prove simple geometric theorems algebraically

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 $(1, \sqrt{3})$ lies on the circle centered at the origin and containing the point $(0, 2)$.
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).
6. **Find the point** on a directed line segment between two given points that partitions the segment in a given ratio.
7. **Use coordinates** to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. ★

Geometric Measurement and Dimension G-GMD

Explain volume formulas and use them to solve problems

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.
2. (+) **Give an informal argument** using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
3. **Use volume formulas** for cylinders, pyramids, cones, and spheres to solve problems. ★

Visualize relationships between two-dimensional and three-dimensional objects

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.

Modeling with Geometry G-MG

Apply geometric concepts in modeling situations

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).★
2. **Apply concepts** of density based on area and volume in **modeling** situations. ★
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). ★

Mathematics Standards for High School specify the mathematics that all students should study in order to be college and career ready. All standards without a (+) symbol should be in the common mathematics curriculum for all college and career ready students. Standards with a (+) symbol may also appear in courses intended for all students. Modeling Standards are indicated by the star symbol (★).