

2005 Geometry Standards

Algebra Strand

Note: The algebraic skills and concepts within the Algebra process and content performance indicators must be maintained and applied as students are asked to investigate, make conjectures, give rationale, and justify or prove geometric concepts.

Geometry Strand

Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.

Geometric Relationships

Note: Two-dimensional geometric relationships are addressed in the Informal and Formal Proofs band.

- G.G.1 Know and apply that if a line is perpendicular to each of two intersecting lines at their point of intersection, then the line is perpendicular to the plane determined by them.
- G.G.2 Know and apply that through a given point there passes one and only one plane perpendicular to a given line.
- G.G.3 Know and apply that through a given point there passes one and only one line perpendicular to a given plane.
- G.G.4 Know and apply that two lines perpendicular to the same plane are coplanar.
- G.G.5 Know and apply that two planes are perpendicular to each other if and only if one plane contains a line perpendicular to the second plane.
- G.G.6 Know and apply that if a line is perpendicular to a plane, then any line perpendicular to the given line at its point of intersection with the given plane is in the given plane.
- G.G.7 Know and apply that if a line is perpendicular to a plane, then every plane containing the line is perpendicular to the given plane.
- G.G.8 Know and apply that if a plane intersects two parallel planes, then the intersection is two parallel lines.
- G.G.9 Know and apply that if two planes are perpendicular to the same line, they are parallel.
- G.G.10 Know and apply that the lateral edges of a prism are congruent and parallel.
- G.G.11 Know and apply that two prisms have equal volumes if their bases have equal areas and their altitudes are equal.
- G.G.12 Know and apply that the volume of a prism is the product of the area of the base and the altitude.
- G.G.13 Apply the properties of a regular pyramid, including:
- lateral edges are congruent
 - lateral faces are congruent isosceles triangles
 - volume of a pyramid equals one-third the product of the area of the base and the altitude
- G.G.14 Apply the properties of a cylinder, including:
- bases are congruent
 - volume equals the product of the area of the base and the altitude
 - lateral area of a right circular cylinder equals the product of an altitude and the circumference of the base
- G.G.15 Apply the properties of a right circular cone, including:
- lateral area equals one-half the product of the slant height and the circumference of its base
 - volume is one-third the product of the area of its base and its altitude
- G.G.16 Apply the properties of a sphere, including:

- the intersection of a plane and a sphere is a circle
- a great circle is the largest circle that can be drawn on a sphere
- two planes equidistant from the center of the sphere and intersecting the sphere do so in congruent circles
- surface area is volume is

Constructions

- G.G.17 Construct a bisector of a given angle, using a straightedge and compass, and justify the construction.
- G.G.18 Construct the perpendicular bisector of a given segment, using a straightedge and compass, and justify the construction.
- G.G.19 Construct lines parallel (or perpendicular) to a given line through a given point, using a straightedge and compass, and justify the construction.
- G.G.20 Construct an equilateral triangle, using a straightedge and compass, and justify the construction.

Locus

- G.G.21 Investigate and apply the concurrence of medians, altitudes, angle bisectors, and perpendicular bisectors of triangles.
- G.G.22 Solve problems using compound loci.
- G.G.23 Graph and solve compound loci in the coordinate plane.

Students will identify and justify geometric relationships formally and informally.

Informal and Formal Proofs

- G.G.24 Determine the negation of a statement and establish its truth value.
- G.G.25 Know and apply the conditions under which a compound statement (conjunction, disjunction, conditional, biconditional) is true.
- G.G.26 Identify and write the inverse, converse, and contrapositive of a given conditional statement and note the logical equivalences.
- G.G.27 Write a proof arguing from a given hypothesis to a given conclusion.
- G.G.28 Determine the congruence of two triangles by using one of the five congruence techniques (SSS, SAS, ASA, AAS, HL), given sufficient information about the sides and/or angles of two congruent triangles.
- G.G.29 Identify corresponding parts of congruent triangles.
- G.G.30 Investigate, justify, and apply theorems about the sum of the measures of the angles of a triangle.
- G.G.31 Investigate, justify, and apply the isosceles triangle theorem and its converse.
- G.G.32 Investigate, justify, and apply theorems about geometric inequalities, using the exterior angle theorem.
- G.G.33 Investigate, justify, and apply the triangle inequality theorem.
- G.G.34 Determine either the longest side of a triangle given the three angle measures or the largest angle given the lengths of three sides of a triangle.
- G.G.35 Determine if two lines cut by a transversal are parallel, based on the measure of given pairs of angles formed by the

transversal and the lines.

- G.G.36 Investigate, justify, and apply theorems about the sum of the measures of the interior and exterior angles of polygons.
- G.G.37 Investigate, justify, and apply theorems about parallelograms involving their angles, sides, and diagonals.
- G.G.38 Investigate, justify, and apply theorems about parallelograms involving their angles, sides, and diagonals.
- G.G.39 Investigate, justify, and apply theorems about special parallelograms (rectangles, rhombuses, squares) involving their angles, sides, and diagonals.
- G.G.40 Investigate, justify, and apply theorems about trapezoids (including isosceles trapezoids) involving their angles, sides, medians, and diagonals.
- G.G.41 Justify that some quadrilaterals are parallelograms, rhombuses, rectangles, squares, or trapezoids.
- G.G.42 Investigate, justify, and apply theorems about geometric relationships, based on the properties of the line segment joining the midpoints of two sides of the triangle.
- G.G.43 Investigate, justify, and apply theorems about the centroid of a triangle, dividing each median into segments whose lengths are in the ratio 2:1.
- G.G.44 Establish similarity of triangles, using the following theorems: AA, SAS, and SSS.
- G.G.45 Investigate, justify, and apply theorems about similar triangles.
- G.G.46 Investigate, justify, and apply theorems about proportional relationships among the segments of the sides of the triangle, given one or more lines parallel to one side of a triangle and intersecting the other two sides of the triangle.
- G.G.47 Investigate, justify, and apply theorems about mean proportionality:
- the altitude to the hypotenuse of a right triangle is the mean proportional between the two segments along the hypotenuse
 - the altitude to the hypotenuse of a right triangle divides the hypotenuse so that either leg of the right triangle is the mean proportional between the hypotenuse and segment of the hypotenuse adjacent to that leg
- G.G.48 Investigate, justify, and apply the Pythagorean theorem and its converse.
- G.G.49 Investigate, justify, and apply theorems regarding chords of a circle:
- perpendicular bisectors of chords
 - the relative lengths of chords as compared to their distance from the center of the circle
- G.G.50 Investigate, justify, and apply theorems about tangent lines to a circle:
- a perpendicular to the tangent at the point of tangency
 - two tangents to a circle from the same external point
 - common tangents of two non-intersecting or tangent circles
- G.G.51 Investigate, justify, and apply theorems about the arcs determined by the rays of angles formed by two lines intersecting a

circle when the vertex is:

- inside the circle (two chords)
- on the circle (tangent and chord)
- outside the circle (two tangents, two secants, or tangent and secant)

G.G.52 Investigate, justify, and apply theorems about arcs of a circle cut by two parallel lines

G.G.53 Investigate, justify, and apply theorems regarding segments intersected by a circle:

- along two tangents from the same external point
- along two secants from the same external point
- along a tangent and a secant from the same external point
- along two intersecting chords of a given circle

Students will apply transformations and symmetry to analyze problem solving situations.

Transformational Geometry

G.G.54 Define, investigate, justify, and apply isometries in the plane (rotations, reflections, translations, glide reflections)

Note: Use proper function notation.

G.G.55 Investigate, justify, and apply the properties that remain invariant under translations, rotations, reflections, and glide reflections

G.G.56 Identify specific isometries by observing orientation, numbers of invariant points, and/or parallelism

G.G.57 Justify geometric relationships (perpendicularity, parallelism, congruence) using transformational techniques (translations, rotations, reflections)

G.G.58 Define, investigate, justify, and apply similarities (dilations and the composition of dilations and isometries)

G.G.59 Investigate, justify, and apply the properties that remain invariant under similarities

G.G.60 Identify specific similarities by observing orientation, numbers of invariant points, and/or parallelism

G.G.61 Investigate, justify, and apply the analytical representations for translations, rotations about the origin of 90° and 180° , reflections over the lines $x = 0$, $y = 0$, and $y = x$, and dilations centered at the origin

Students will apply coordinate geometry to analyze problem solving situations.

Coordinate Geometry

G.G.62 Find the slope of a perpendicular line, given the equation of a line

- G.G.63 Determine whether two lines are parallel, perpendicular, or neither, given their equations
- G.G.64 Find the equation of a line, given a point on the line and the equation of a line perpendicular to the given line
- G.G.65 Find the equation of a line, given a point on the line and the equation of a line parallel to the desired line
- G.G.66 Find the midpoint of a line segment, given its endpoints
- G.G.67 Find the length of a line segment, given its endpoints
- G.G.68 Find the equation of a line that is the perpendicular bisector of a line segment, given the endpoints of the line segment
- G.G.69 Investigate, justify, and apply the properties of triangles and quadrilaterals in the coordinate plane, using the distance, midpoint, and slope formulas
- G.G.70 Solve systems of equations involving one linear equation and one quadratic equation graphically
- G.G.71 Write the equation of a circle, given its center and radius or given the endpoints of a diameter
- G.G.72 Write the equation of a circle, given its center and radius or given the endpoints of a diameter
Note: The center is an ordered pair of integers and the radius is an integer.
- G.G.73 Find the center and radius of a circle, given the equation of the circle in center-radius form
- G.G.74 Graph circles of the form $(x - h)^2 + (y - k)^2 = r^2$