

**Geometry B**

**Curriculum Framework**

**2016**

Compiled using the Arkansas Mathematics Standards

Course Title: Geometry B

Course/Unit Credit: 1

Course Number: 431200

Teacher Licensure: Please refer to the Course Code Management System (<https://adedata.arkansas.gov/ccms/>) for the most current licensure codes.

# Grades: 9-12

Prerequisite: Algebra I and Geometry A or Algebra A/B and Geometry A

**Course Description:** “The fundamental purpose of the course in Geometry is to formalize and extend students’ geometric experiences from the middle grades. Students explore more complex geometric situations and deepen their explanations of geometric relationships, moving towards formal mathematical arguments. Important differences exist between this Geometry course and the historical approach taken in Geometry classes. For example, transformations are emphasized early in this course. Close attention should be paid to the introductory content for the Geometry conceptual category found in the high school AMS.

This document was created to delineate the standards for this course in a format familiar to the educators of Arkansas. For the state-provided Algebra A/B, Algebra I, Geometry A/B, Geometry, and Algebra II documents, the language and structure of the Arkansas Mathematics Standards (AMS) have been maintained. The following information is helpful to correctly read and understand this document.

“**Standards** define what students should understand and be able to do.

**Clusters** are groups of related standards. Note that standards from different clusters may sometimes be closely related, because mathematics is a connected subject.

**Domains** are larger groups of related standards. Standards from different domains may sometimes be closely related.”- http://www.corestandards.org/

Standards do not dictate curriculum or teaching methods. For example, just because topic A appears before topic B in the standards for a given grade, it does not necessarily mean that topic A must be taught before topic B. A teacher might prefer to teach topic B before topic A, or might choose to highlight connections by teaching topic A and topic B at the same time. Or, a teacher might prefer to teach a topic of his or her own choosing that leads, as a byproduct, to students reaching the standards for topics A and B.

The standards in this document appear exactly as written in the AMS.

Notes:

1. Teacher notes offer clarification of the standards.
2. The Plus Standards (+) from the Arkansas Mathematics Standards may be incorporated into the curriculum to adequately prepare students for more rigorous courses (e.g., Advanced Placement, International Baccalaureate, or concurrent credit courses).
3. Italicized words are defined in the glossary.
4. All items in a bulleted list must be taught.
5. Asterisks (\*) identify potential opportunities to integrate content with the modeling practice.

**Geometry B**

**Domain Cluster**

|  |  |
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| Congruence |  |
|  | 1. Apply and prove geometric theorems |
|  | 2. Make geometric constructions |
| Similarity, Right Triangles, and Trigonometry |  |
|  | 3. Apply and prove theorems using similarity |
|  | 4. Define trigonometric ratios and solve problems involving right triangles |
|  | 5. Apply trigonometry to general triangles |
| Circles |  |
|  | 6. Understand and apply theorems about circles |
|  | 7. Find arc lengths and areas of sectors of circles |
| Expressing Geometric Properties with Equations |  |
|  | 8. Use coordinates to prove simple geometric theorems algebraically |
| Geometric measurement and dimension |  |
|  | 9. Explain volume formulas and use them to solve problems |
|  | 10. Visualize relationships between two-dimensional and three-dimensional objects |
| Modeling with Geometry |  |
|  | 11. Apply geometric concepts in modeling situations |

Domain: Congruence

Cluster(s): 1. Prove geometric theorems

2. Make geometric constructions

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| HSG.CO.C.9 | 1 | Apply and prove *theorems* about lines and angles  Note: Theorems include but are not limited to: *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.  Note: Proofs are not an isolated topic and therefore should be integrated throughout the course. |
| HSG.CO.C.10 | 1 | Apply and prove *theorems* about triangles  Note: Theorems include but are not limited to: 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.  Note: Proofs are not an isolated topic and therefore should be integrated throughout the course. |
| HSG.CO.C.11 | 1 | Apply and prove *theorems* about quadrilaterals  Note: Theorems include but are not limited to relationships among the sides, angles, and diagonals of quadrilaterals and the following theorems concerning *parallelograms*: opposite sides are *congruent*, opposite angles are congruent, the diagonals of a *parallelogram* bisect each other, and conversely, *rectangles* are *parallelograms* with congruent diagonals.  Note: Proofs are not an isolated topic and therefore should be integrated throughout the course. |
| HSG.CO.D.12 | 1 | Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software)  Note: Constructions may include but are not limited to: 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.  Note: Constructions are not an isolated topic and therefore should be integrated throughout the course. |
| HSG.CO.D.13 | 2 | Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle  Note: Constructions are not an isolated topic and therefore should be integrated throughout the course. |

Domain: Similarity, Right Triangles, and Trigonometry

Cluster(s): 3. Apply and prove theorems involving similarity

4. Define trigonometric ratios and solve problems involving right triangles

5. Apply trigonometry to general triangles

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| HSG.SRT.B.4 | 3 | Use triangle similarity to apply and prove theorems about triangles  Note: Theorems include but are not limited to: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity. |
| HSG.SRT.B.5 | 3 | * Use congruence (SSS, SAS, ASA, AAS, and HL) and similarity (AA~, SSS~, SAS~) criteria for triangles to solve problems * Use congruence and similarity criteria to prove relationships in geometric figures |
| HSG.SRT.C.6 | 4 | 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  For example: Trigonometric ratios are related to the acute angles of a triangle, not the right angle. The values of the trigonometric ratio depend only on the angle. Consider the following three similar right triangles, why are they similar? |

Domain: Similarity, Right Triangles, and Trigonometry

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| HSG.SRT.C.7 | 4 | Explain and use the relationship between the sine and cosine of complementary angles |
| HSG.SRT.C.8 | 4 | Use trigonometric ratios, special right triangles, and/or the Pythagorean Theorem to find unknown measurements of right triangles in applied problems\*  Note: Examples should Including, but are not limited to *angles of elevation*, *angles of depression*, navigation, and surveying. |
| HSG.SRT.D.11 | 5 | (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles  Note: Examples should include, but are not limited to surveying problems and problems related to resultant forces. |

Domain: Circles

Cluster(s): 6. Understand and apply theorems about circles

7. Find arc lengths and areas of sectors of circles

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| HSG.C.A.3 | 6 | * Construct the *inscribed* and *circumscribed* circles of a triangle * Prove properties of angles for a quadrilateral inscribed in a circle |
| HSG.C.B.5 | 7 | * Derive using similarity that the length of the *arc* intercepted by an angle is proportional to the *radius* * Derive and use the formula for the area of a *sector* * Understand the radian measure of the angle as a unit of measure     Note: Connected to F.TF.1 (+) |

Domain: Expressing Geometric Properties with Equations

Cluster(s): 8. Use coordinates to prove simple geometric theorems algebraically

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| HSG.GPE.B.4 | 8 | 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). |
| HSG.GPE.B.6 | 8 | Find the *midpoint* between two given points; and find the endpoint of a line segment given the midpoint and one endpoint  Note: An extension of this standard would be to find the point on a directed line segment between two given points that partitions the segment in a given ratio |
| HSG.GPE.B.7 | 8 | Use coordinates to compute *perimeters* of polygons and areas of triangles and rectangles  Note: Examples should include, but are not limited using the distance formula and area of composite figures. |

Domain: Geometric measurement and dimension

Cluster(s): 9. Explain volume formulas and use them to solve problems

10. Visualize relationships between two-dimensional and three-dimensional objects

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| HSG.GMD.A.1 | 9 | Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume and surface area of a cylinder, pyramid, and cone  For example: Use dissection arguments, Cavalieri’s principle, and informal limit arguments. |
| HSG.GMD.A.2 | 9 | (+) Give an informal argument using Cavalieri’s principle for the formulas for the volume of a sphere and other solid figures    <https://www.illustrativemathematics.org/content-standards/HSG/GMD/A/2/tasks/530> |
| HSG.GMD.A.3 | 9 | * Use volume formulas for cylinders, pyramids, cones, spheres, and to solve problems which may involve composite figures * Compute the effect on volume of changing one or more dimension(s)   For example: How is the volume affected by doubling, tripling, or halving a dimension? |
| HSG.GMD.B.4 | 10 | * Identify the shapes of two-dimensional cross-sections of three- dimensional objects * Identify three-dimensional objects generated by rotations of two-dimensional objects |

Domain: Modeling with Geometry

Cluster(s): 11. Apply geometric concepts in modeling situations

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| HSG.MG.A.1 | 11 | Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder) |
| HSG.MG.A.2 | 11 | Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot) |
| HSG.MG.A.3 | 11 | 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) |

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| Alternate interior angles | Two angles that lie on opposite sides of a transversal between two lines that the transversal intersects |
| Angle | Two noncollinear rays having a common endpoint |
| Angle of depression | The angle formed by a horizontal line and the line of sight of a viewer looking down |
| Angle of elevation | The angle formed by a horizontal line and the line of sight of a view looking up |
| Arcs | Two points on a circle and the continuous part of the circle between them |
| Area | The measure of the size of the interior of a figure, expressed in square units |
| Cavalieri’s principle | If two solids have the same cross-sectional area whenever they are sliced at the same height, then the two solids have the same volume |
| Center of a circle | The coplanar point from which all points of the circle are the same distance |
| Central angle | An angles whose vertex is the center of a circle and whose sides pass through the endpoints of an arc  ABC is a central angle of circle B.  A  B  C |
| Chord | A segment whose endpoints lie on the circle  B  is a chord on circle M.  M  A |
| Circle | The set of all points in a plane at a given distance from a given point |
| Circumference | The perimeter of a circle, which is the distance around a circle |
| Circumscribed (about a circle) | Having all sides tangent to the circle  The triangle is circumscribed about the circle. |
| Circumscribed (about a polygon) | Each vertex of the polygon lines on the circle  The circle is circumscribed about the triangle. |
| Complementary angles | Two angles (adjacent or nonadjacent) whose sum is 90 degrees |
| Conditional statements | A statement that can be expressed in ‘if-then’ form |
| Cone | A three dimensional figure with one circular base and a vertex |
| Congruent | Identical in shape and size (angles, line segments, circles or polygons) |
| Contrapositive | The statement formed by exchanging and negating the hypothesis and conclusion of a conditional statement |
| Converse | The statement formed by exchanging the hypothesis and conclustion of a conditional statement |
| Corresponding (side or angle) | A side (or angle) of a polygon that is in the same position as a side (or angle) of a congrent or similar polygon |
| Corresponding angles | Two angles formed by a transversal intersecting two lines that lie in the same position relative to the two lines and the transversal |
| Cross-section | A plane figured obtained by the intersection of a solid with a plane |
| Cylinder | A three dimensional figure with congruent, parallel bases |
| Deductive reasoning | The process of showing that certain statements follow loginally from agree-upon assumptions and proven facts |
| Dilation | A nonrigid transformation that enlarges or reduces a geometric figure by a scale factor relative to a point    Original  Image |
| Inductive reasoning | The process of observing data, recognizing patterns, and making generalizations about those patterns |
| Inscribed (in a circle) | Having each vertex on the circle  The triangle is inscribed in the circle. |
| Interior angle | An angle of a polygon that lies inside the polygon |
| Inverse statement | The statement formed by negating the hypothesis and conclusion of a conditional statement |
| Line | A straight, continuous arrangement of infinitelymany points extending forever in two directions |
| Line segment | Two points and all the points between them that are collinear with the two points |
| Median | A line segment connecting a vertex of a triangle to the midpoint of the opposite side  A  B  D  C  is the median of triangle ADC. |
| Midpoint | The point on the line segment that is the same distance from both endpoints;bisects the segment |
| Parallel lines (segments or rays) | Coplanar lines(segment or rays) that do not intersect |
| Parallelogram | A quadrilateral with both paris of opposite sides parallel |
| Perimeter | The sum of the lengths of the sides of a polygon; distance around |
| Perpendicular bisector | A line (segment or ray) that divides a line segment into two congruent parts and is perpendicular to the line segment  *m*  Line *m* is the perpendicular bisector of .  A  C  B |
| Perpendicular lines (segments or rays) | Lines (segments or rays) that meet at 90o angles |
| Plane | A flat surface that extends indefinitely along its edges; two-dimensional with a length and width, but no thickness |
| Point | A locatoin with no size or dimension |
| Polygon | A closed plane figure whose sides are segments that intersect only at their endpoints, with each segment intersecting exactly two other segments |
| Pyramid | A polyhedron consisting f a polygon base and triangular lateral faces that share a common vertex |
| Radius (circle or sphere) | A line segment from the center of a circle or sphere to a point on the circle or sphere |
| Rectangle | A parallelogram with opposite sides congruent |
| Reflection | An isometry in which every point and its image are on opposite sides and the same distance from a fixed line |
| Regular polygon | A polygon with all sides congruent and all angles congruent |
| Rigid motion | A transformation that preserves size and shape; image congruent to original figure |
| Rotation | An isometry in which each point is moved by the same angle measure in the same direction along a circular path about a fixed point |
| Scale factor | The ratio of corresponding lengths in similar figures |
| Sector of a circle | The region between two radii and an arc of the circle |
| Similarity | A transformation that preserves angles and changes all distances in the same ratio |
| Similar | Two figures are similar if and only if all corresponding angles are congruent and lengths of all corresponding sides are proportional |
| Slope | The ratio of the vertical change to the horizontal change between two points on a line |
| Special right triangles | A triangle whose angles are either 30-60-90 degrees or 45-45-90 degrees |
| Sphere | The set of all points in space at a given distance from a given point |
| Supplementary angles | Two angles (adjacent or nonadjacent) whose sum is 180 degrees |
| Surface area | The sum of the areas of all of the surfaces of a solid |
| Tangent line | A line in a plane of the circle that intersects the circle in only one point  is a tangent of circle V.  A  B  V |
| Theorem | A conjecture that has been proved within a deductive system |
| Transformation | A rule that assigns to each point of a figure another poin in the plane, called its image |
| Translation | An isometry in which each point is moved by the same translation vector |
| Transversal | A line that intersect two or more other coplanar lines |
| Trapezoid | A quadrilateral with at least one pair of opposite sides parallel |
| Venn diagram | A concept map of overlapping circles or ovals that shows the relationships among members of different sets  Parallelograms  Rhombuses  Squares  Rectangles |
| Vertical angles | Nonadjacent, nonoverlapping congruent angles formed by two intersecting lines; share a common vertex  1 and 3 are vertical angles.  2 and 4 are vertical angles.  3  2  4  1 |
| Volume | A measure of the amount of space contained in a solid, expressed in cubic units |