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

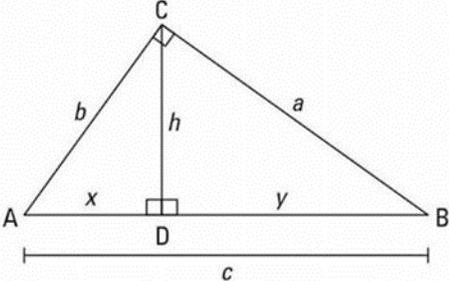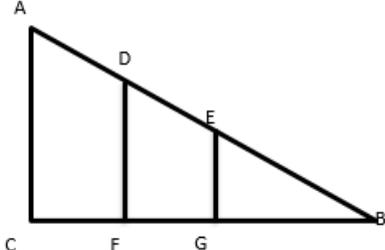| Domain	Cluster
Congruence	
	1. Apply and prove geometric theorems
	2. Make geometric constructions
Similarity, Right Triangles, and Trigonometry	
	3. Apply and prove theorems using similarity
	4. Define trigonometric ratios and solve problems involving right triangles
	5. Apply trigonometry to general 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

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Domain: Congruence
      Cluster(s): 1. Prove geometric theorems
                   2. Make geometric constructions

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

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. $$\frac{x}{b} = \frac{b}{c}, \qquad \frac{y = c - x}{a} = \frac{a}{c}$$ $$x = \frac{b^2}{c}, \qquad c - x = \frac{a^2}{c}$$ $$x + (c - x) = c$$ $$\frac{a^2}{c} + \frac{b^2}{c} = c$$ $$a^2 + b^2 = c^2$$
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
Cluster(s): 3. Apply and prove theorems involving similarity
4. Define trigonometric ratios and solve problems involving right triangles
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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

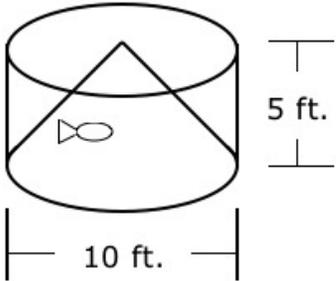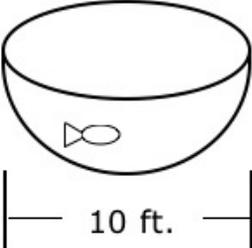| HSG.C.A.3	6	• Construct the *inscribed* and *circumscribed* circles of a triangle • Prove properties of angles for a quadrilateral inscribed in a circle
HSG.C.B.5	7	• Derive using similarity that the length of the *arc* intercepted by an angle is proportional to the *radius* • Derive and use the formula 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

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 $(1, \sqrt{3})$ 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.

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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
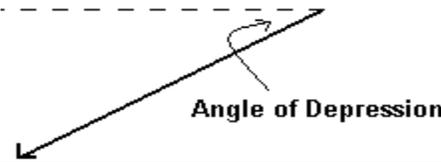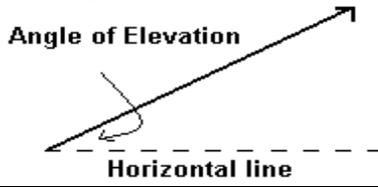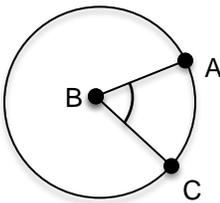
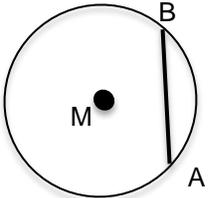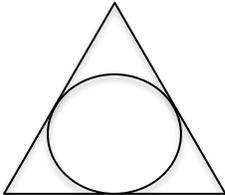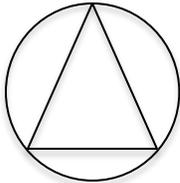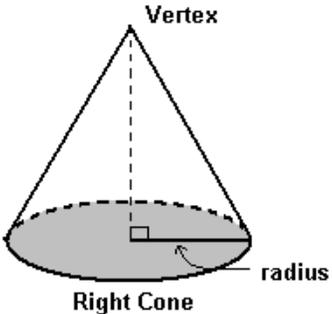|		
HSG.GMD.A.1	9	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume and surface area of a cylinder, pyramid, and cone For example: Use dissection arguments, Cavalieri's principle, and informal limit arguments.
HSG.GMD.A.2	9	(+) Give an informal argument 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

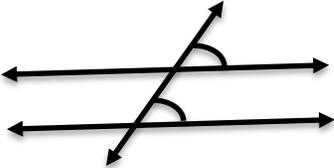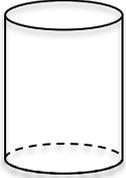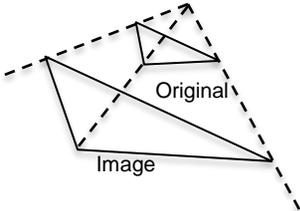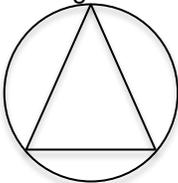   Cluster(s): 11. Apply geometric concepts in modeling situations

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
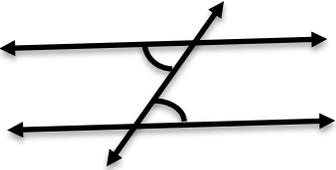
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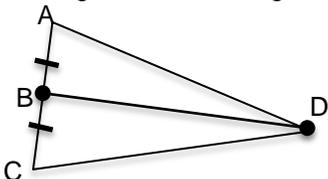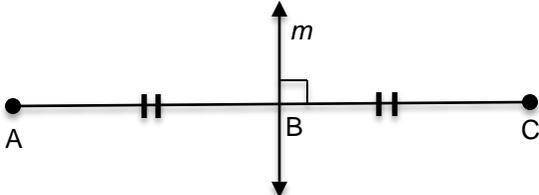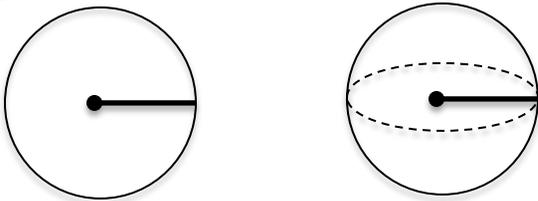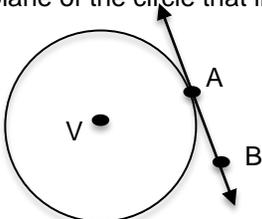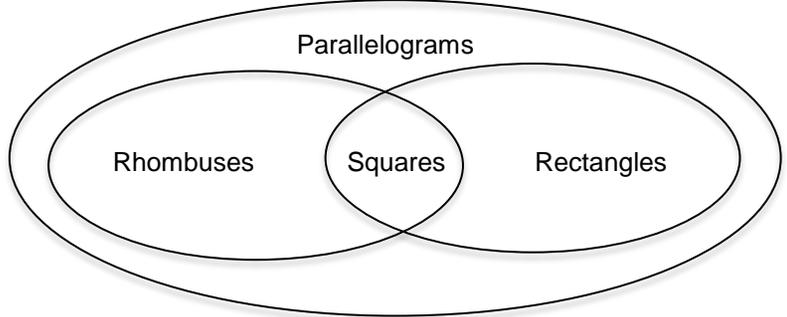| Chord	A segment whose endpoints lie on the circle
	$\overline{AB}$ is a chord on circle M.
Circle	The set of all points in a plane at a given distance from a given point
Circumference	The perimeter of a circle, which is the distance around a circle
Circumscribed (about a circle)	Having all sides tangent 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

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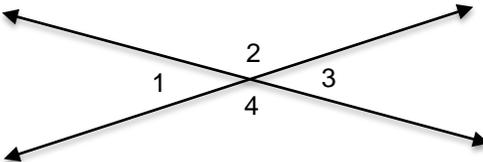| Congruent	Identical in shape and size (angles, line segments, circles or polygons)
Contrapositive	The statement formed by exchanging and negating the hypothesis and conclusion of a conditional statement
Converse	The statement formed by exchanging the hypothesis and conclustion of a conditional statement
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
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

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Median	A line segment connecting a vertex of a triangle to the midpoint of the opposite side
	$\overline{DB}$ 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
	Line m is the perpendicular bisector of $\overline{AC}$.
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

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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 $\overline{AB}$ is a tangent of circle 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

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Vertical angles	Nonadjacent, nonoverlapping congruent angles formed by two intersecting lines; share a common vertex
	$\angle$ 1 and $\angle$ 3 are vertical angles. $\angle$ 2 and $\angle$ 4 are vertical angles.
Volume	A measure of the amount of space contained in a solid, expressed in cubic units