Pre-AP Geometry Year-at-a-Glance 2018-2019

Year-at-a-Glance			
FIRST SEMESTER		SECOND SEMESTER	
Unit 1 **Foundations of Geometry**	**Unit 2** **Equations of Lines, Angle-Pairs, Triangles**	**Unit 3** **Right Triangles, Polygons, Transformations**	**Unit 4** **Similarity, Measurements, and Dimension**
1st 9-weeks	2nd 9-weeks	3rd 9-weeks	4th 9- weeks
Lines and Angles ● Seg Add Post ● Angle Add Post ● Classify Angles ● Midpoint formula ● Distance formula ● Perimeter, Area, Circumf. ● Perpendicular lines ● Parallel lines ● Midpoint **Circles** ● Equation of a Circle ● Arcs, Sectors, Angles ● Tangents, Secants, Chords ● Inscribed/Circumscribed Figures ● Radians	**Eq. of Lines & Angle Pair Rel.** ● Equations of lines ● Proofs ● // & ⊥ equations of lines ● Vertical Angles ● ∠ pairs with // lines ● Basic Triangle Theorems ○ Triangle Sum ○ Polygon Sum **Congruence** ● Congruence ● Triangle Congruence Theorems **Triangles** ● Isosceles Triangle Thm ● Midsegments of a triangle ● Concurrent lines in triangles ● Triangle Inequalities	**Similarity** ● Scale Factor ● Dilations ● Ratios and Proportions ● Similarity Triangle Similarity Theorems **Right Triangles** ● Trigonometry ● Special Right Triangles ● Pythagorean Theorem ● Law of Sines/Cosines **Polygons** ● Quadrilaterals ● Coordinate proofs ● Coordinate perimeter/area computation	**Measurement & Dimension** ● Volume and effects of changing dimensions ● Cross-sections of 3D objects ● 3D objects created by rotations of 2D ● Density, area, and volume in modeling situations ● Informal arguments of area, volume, surface area, etc **Transformations** ● Rigid motion/congruence ● Translations ● Rotations ● Reflections

COLOR KEY:

BLUE - Power Standard

BLACK - Additional Skills

RED - Closing the Achievement Gap
Green - Familiarity Only

Unit 1

Unit 2

Unit 3

Unit 4

Unit 5

Unit 1	Foundations of Geometry	Grade Level	Pre-AP Geometry	Approx length	9 weeks

CPSD Power Standards with Student Learning Objectives

HSG.CO.C.9 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.

Student-Friendly Objectives:

- I can use the segment addition postulate to find the lengths of segments, and to determine if a point is a midpoint.
- I can use the angle addition postulate to find the measure of angles, and to determine if a ray is an angle bisector.
- I can recognize angle or segment bisectors, and use this to solve problems.

HSG.C.A.2 10 Identify, describe, and use relationships among angles, radii, segments, lines, arcs, and chords as related to circles Note: Examples include but are not limited to the following: the relationship between central, inscribed, and circumscribed angles and their intercepted arcs; angles inscribed in a semicircle are right angles; the radius of a circle is perpendicular to a tangent line of the circle at the point of tangency.

Student-Friendly Objectives:

- I can employ correct vocabulary for parts of circles in my work and explanations.
- I can name and classify arcs (minor, semicircle, major).
- I can calculate the measure of an arc given a central or an inscribed angle.
- I can calculate the length of an arc and express it in either terms of pi or as an approximated answer.
- I can use angle relationships of circles to find unknown angle measures.
- I can explain that inscribed angles have a measure that is half of its intercepted arc measure.
- I can explain that circumscribed angles have a measure that is half the difference of the two intercepted arcs.
- I can evaluate segment relationships of circles to find unknown segment lengths.
- I can determine if a segment is tangent to a circle by using the Pythagorean Theorem.

Learning Indicators of Power Standards

Students will know…	And be able to…
● The angle addition postulate ● The segment addition postulate ● The definition of a bisector	● Use algebra to solve for missing angles, segments, or variables. ● Recognize and use bisectors to solve problems. ● Apply the distance and midpoint formula to solve problems.

• The distance and midpoint formulas • Area, perimeter, and circumference • The parts of a circle: radius, diameter, chord, secant, and tangent • The difference between central, inscribed, and circumscribed angles • Naming conventions for classification of arcs • All circles are similar • Congruent circles have congruent radii • That central angle measures are equivalent to their intercepted arc measure • That inscribed angles are ½ the measure of their intercepted arc • The difference in arc length and arc measure • That arc length is a section/portion of the circumference of the circle • That answers left in terms of π are exact • That a tangent is always perpendicular to a radius at the point of tangency • The standard form for the equation of a circle	• Find the area, perimeter, and circumference of basic geometric shapes. • Identify segments related to circles: radius, diameter, chord, secant tangent. • Identify angles related to circles: central, inscribed, circumscribed. • Classify arcs as minor, semi-circle, or major. • Name arcs using the correct naming conventions. • Find the measure of an arc given the central angle measure. • Find the length of an arc given the central angle measure and the measure of the radius, diameter, or circumference. • Find angle measures given arc measures. • Find arc measures given angle measures. • Apply properties of circles in real life situations to solve for a given problem.

Additional Arkansas State Standards

- **HSG.CO.A.1** Based on the undefined notions of point, line, plane, distance along a line, and distance around a circular arc, define:
  - Angle
  - Line segment
  - Circle
  - Perpendicular lines
  - Parallel lines
- **HSG.GPE.B.6** 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** 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.
- **HSG.GMD.A.1** 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.C.A.1** Prove that all circles are similar
- **HSG.C.A.3**
  - Construct the inscribed and circumscribed circles of a triangle
  - Prove properties of angles for a quadrilateral inscribed in a circle
- **HSG.C.B.5 11**
  - 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

- **HSG.GPE.A.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 Note: Students should also be able to identify the center and radius when given the equation of a circle and write the equation given a center and radius.

Unit 2	Equations of Lines, Angle-Pairs, Triangles	Grade Level	Pre-AP Geometry	Approx Length	9 weeks

CPSD Power Standards with Student Learning Objectives

HSG.CO.C.9 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.

Student-Friendly Objectives

- I can recognize angle pairs.
- I can identify the relationships among various angle pairs.
- I can use the relationships among angle pairs to solve problems.

HSG.SRT.B.5 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

Student-Friendly Objectives:

- I can prove two triangles are congruent using one of five methods: SSS, SAS, ASA, AAS, or HL.
- I can explain why the five methods for triangle congruence are shortcuts.
- I can explain how CPCTC allows us to solve for other parts of congruent triangles.

HSG.CO.C.10 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.

Student-Friendly Objectives

- I can find the measure of a missing angle in a triangle when I know the other two angle measures.
- I can use the base angles theorem to find the measure of a missing angle in an isosceles triangle.
- I can calculate the sum of the measures of the interior angles of a polygon.
- I can use what I know about interior and exterior angle measures in polygons to solve problems.
- I can identify a midsegment and use it to solve problems.
- I can describe, identify, and sketch a median, an altitude, a perpendicular bisector, and an angle bisector.
- I can order the sides of a triangle from shortest to longest given the angles measures.
- I can order the angles of a triangle from least to greatest given the lengths of the sides.
- I can determine if three side lengths can create a triangle.

- I can calculate all possible values for the missing side of a triangle when given two sides.

Learning Indicators of Power Standards

Students will know…

- Angle pairs relationships
  - Vertical, adjacent, congruent, complementary, supplementary
- Congruent alternate interior angles, corresponding angles, alternate exterior angles, or supplementary consecutive interior angles signify parallel lines
- There are 5 methods used to prove triangles are congruent (SSS, SAS, ASA, AAS, HL)
- Congruence is associated with rigid transformations (rotations, reflections, translations)
- Corresponding parts of congruent triangles are congruent (CPCTC)
- Triangle Sum Theorem
- Isosceles Triangle Theorem
- Polygon Sum Theorem
- Exterior Angle Theorem

And be able to…

- Use algebra to solve for missing angles, segments, or variables.
- Recognize angle pairs, identify their relationships, and use this to solve problems.
- Prove congruence of triangles.
- Employ CPCTC to solve problems.
- Model geometric situations and solve problems using algebraic properties.
- Solve real-world problems and prove relationships using similarity and congruence theorems of triangles.

Additional Arkansas State Standards

- **HSG.GPE.B.5**
  - Prove the slope criteria for parallel and perpendicular lines
  - Use the slope criteria for parallel and perpendicular lines to solve geometric problems
  - Note: Examples should include but are not limited to finding the equation of a line parallel or perpendicular to a given line that passes through a given point.

Unit 3	Right Triangles, Polygons, Transformations	Grade Level	Pre-AP Geometry	Approx Length	9-weeks

CPSD Power Standards with Student Learning Objectives

HSG.SRT.B.5 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

Student-Friendly Objectives:

- I can use ratios and proportions to solve problems involving similar figures.
- I can use similarity and congruence theorems for triangles to solve real-world problems.

HSG.SRT.C.8 Use trigonometric ratios, special right triangles, and 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.

Student-Friendly Objectives:

- I can employ the Pythagorean Theorem to solve real world problems.
- I can apply 30-60-90 right triangle ratios or 45-45-90 right triangle ratios to solve for missing sides in a right triangle.
- I can identify sides of a right triangle (given an angle) as opposite, adjacent, or hypotenuse.
- I can write sine, cosine, and tangent ratios for an angle in a right triangle.
- I can determine when to use a trig ratio or the trig inverse.
- I can solve for a missing value in a trig ratio problem.
- I can use technology appropriately to solve problems involving trig ratios.

HSG.CO.C.11 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.

Student-Friendly Objectives:

- I can classify quadrilaterals using deductive reasoning (proof using geometric strategies).
- I can calculate segment lengths or angle measures of quadrilaterals.
- I can use the properties of parallelograms, rectangles, rhombi, squares and trapezoids to model geometric situations and solve problems using algebraic properties.
- I can justify that a quadrilateral is/is not a parallelogram by citing evidence.

Learning Indicators of Power Standards

Students will know…

- There are 3 methods used to prove triangles are similar (SSS~, SAS~, AA~)
- Similarity is associated with dilations, which are not rigid transformations
- The Pythagorean Theorem
- 30-60-90 right triangles have constant ratios of 1,2, $\sqrt{3}$
- 45-45-90 right triangles have constant ratios of 1,1, $\sqrt{2}$
- The sine of an angle represents the ratio of the measures of the opposite side to the hypotenuse
- The cosine of an angle represents the ratio of the measures of the adjacent side to the hypotenuse
- The tangent of an angle represents the ratio of the measures of the opposite side to the adjacent side
- The five characteristics of parallelograms: opposite sides are congruent and parallel; opposite angles are congruent; consecutive angles are supplementary; diagonals bisect each other.
- The characteristics of a rectangle include those of a parallelogram AND 4 right angles; diagonals are congruent
- The characteristics of a rhombus include those of a parallelogram AND diagonals are perpendicular; 4 congruent sides
- The characteristics of a square include ALL properties of a parallelogram, rectangle and rhombus
- Base angles of an isosceles trapezoid are congruent
- Legs of an isosceles trapezoid are congruent
- Trapezoids have at least one pair of parallel sides

And be able to…

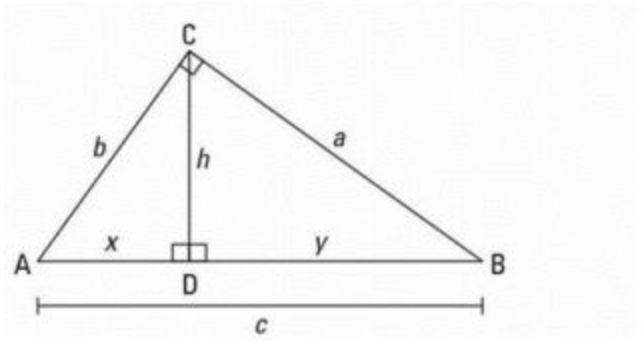
- Solve real-world problems and prove relationships using similarity and congruence theorems of triangles.
- Apply ratios and proportions to solve problems using the properties of similar figures (indirect measurement).
- Identify parts of a right triangle (hypotenuse, adjacent side, opposite side) in reference to a given acute angle.
- Use technology appropriately with respect to trigonometry.
- Write each trig ratio for a given angle measure.
- Solve for a missing value in a trig ratio problem including how and when to use the trig inverse.
- Find the missing measures of right triangles.
- Solve real-world problems involving right triangles using trigonometric ratios and the Pythagorean Theorem or properties of similar figures.
- Classify a quadrilateral as a parallelogram, rectangle, rhombus, square, trapezoid, isosceles trapezoid, or none of these.
- Prove theorems about quadrilaterals using distance formula, midpoint formula, and slope.
- Model geometric situations and solve problems using algebraic properties.
- Apply the properties of parallelograms, rectangles, rhombi, squares and trapezoids to solve for missing values.

Additional Arkansas State Standards

- **HSG.CO.B.8** Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions Investigate congruence in terms of rigid motion to develop the criteria for triangle congruence (ASA, SAS, AAS, SSS, and HL) Note: The emphasis in this standard should be placed on investigation.
- **HSG.SRT.D.11** 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.
- **HSG.SRT.C.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 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?

- **HSG.SRT.C.7** Explain and use the relationship between the sine and cosine of complementary angles
- **HSG.GPE.B.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).
- **HSG.SRT.B.4** Use triangle similarity to apply and prove theorems about triangles Note: 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.



$$\frac{x}{b}=\frac{b}{c}, \qquad \frac{y=c-x}{a}=\frac{a}{c}$$

$$x=\frac{b^2}{c}, \qquad c-x=\frac{a^2}{c}$$

$$x+(c-x)=c$$

$$\frac{a^2}{c}+\frac{b^2}{c}=c$$

$$a^2+b^2=c^2$$

- **HSG.GMD.A.2** Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures
- **HSG.SRT.A.1** Verify experimentally the properties of dilations given by a center and a scale factor
  - 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
  - The dilation of a line segment is longer or shorter in the ratio given by the scale factor http://www.shmoop.com/common-core-standards/ccss-hs-g-srt-1a.html
- **HSG.SRT.A.2** Given two figures:
  - Use the definition of similarity in terms of similarity transformations to determine 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
- **HSG.SRT.A.3** Use the properties of similarity transformations to establish the AA~, SAS~, SSS~ criteria for two triangles to be similar

Unit 4	Similarity, Measurements, and Dimension	Grade Level	Pre-AP Geometry	Approx Length	9 weeks

CPSD Power Standards with Student Learning Objectives

HSG.GMD.A.3 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?

Student-Friendly Objectives:

- I can determine the correct volume formula to use based on the shape(s).
- I can calculate the volume of solids with correct formulas.
- I can modify formulas for composite figures.
- I can compare the effect on the volume when a dimension is changed.
- I can use geometric concepts (such as Pythagorean Theorem, special right triangles, etc.) to determine volume of composite figures.
- I can model and solve geometric problems using reasoning and/or algebraic properties.

Learning Indicators of Power Standards

Students will know…

- Vocabulary that relates to 3-D shapes including the dimensions of each formula
- The effects on the volume of a shape by changing a dimension(doubling, tripling, or halving)
- Composite shapes can be decomposed into cylinders, pyramids, cones, and prisms.
- Rigid transformations are isometries

And be able to…

- Identify which measurements should be used in a volume formula
- Calculate the volume of a solid given its dimensions
- Compare the volumes of different composite figures
- Find a dimension given the volume of a figure
- Determine what geometric figures are used to create a composite figure and then use the appropriate formulas to calculate volume of the composite

Additional Arkansas State Standards

- **HSG.CO.A.2**
  - Represent transformations in the plane (e.g., using transparencies, tracing paper, 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 dilation)
- **HSG.CO.A.3** Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself
- **HSG.CO.A.4** Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments
- **HSG.CO.A.5**

    - Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure (e.g., using graph paper, tracing paper, miras, geometry software)
    - Specify a sequence of transformations that will carry a given figure onto another
- **HSG.CO.B.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
- **HSG.CO.B.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
- **HSG.GMD.B.4**
    - Identify the shapes of two-dimensional cross-sections of three- dimensional objects
    - Identify three-dimensional objects generated by rotations of two-dimensional objects
- **HSG.MG.A.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)
- **HSG.MG.A.2** 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 16 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)