SECTION SIX: Draft High School Geometry

6A: Core Geometry Focus

The standards listed in this table name the priority instructional content for high school geometry (HSG). The right-hand column contains draft focus content that would be core content for all students in a student's first two credits after K-8 mathematics. Specific modeling standards are indicated by a star symbol (★).

HSG.CO – Congruence

Standard	Standard Statements (Jan 2021 Draft)
HSG.CO.A.1	Use definitions of geometric figures and geometric relationships to justify the solutions of problems.
HSG.CO.A.5	Develop definitions of rotations, reflections, and translations in authentic contexts. Apply these definitions to transform a shape or map between two given shapes. Integrated with Standard(s): HSG.CO.A.2; HSG.CO.A.4
HSG.CO.B.7	Apply and justify triangle congruence theorems in authentic contexts. Integrated with Standard(s): HSG.CO.B.8
HSG.CO.C.9	Justify theorems of line relationships, angles, triangles, and parallelograms; and use them to solve problems in authentic contexts. Integrated with Standard(s): HSG.CO.C.10
HSG.CO.D.12	Perform geometric constructions with a variety of tools and methods.

HSG.SRT – Similarity, Right Triangles, & Trigonometry

Standard	Standard Statements (Jan 2021 Draft)
HSG.SRT.A.5	Use similarity theorems to determine whether two triangles are similar. Verify experimentally the properties of dilations given by a center and a scale factor. Solve problems in authentic contexts involving similar triangles or dilations. Integrated with Standard(s): HSG.SRT.A.1, HSG.SRT.A.2, HSG.SRT.A.3
HSG.SRT.C.8	Apply sine, cosine, and tangent ratios, and the Pythagorean Theorem, to solve problems in authentic contexts. Integrated with Standard(s): HSG.SRT.C.6, HSG.SRT.C.7

HSG.GPE – Expressing Geometric Properties with Equations

Standard	Standard Statements (Jan 2021 Draft)
HSG.GPE.A.1	Apply the Pythagorean Theorem in authentic contexts, and develop the standard form for the equation of a circle.
HSG.GPE.B.4	Use Cartesian coordinates to determine parallel and perpendicular relationships, and distance in the coordinate plane.
HSG.GPE.B.5	Use the slopes of segments and the coordinates of the vertices of triangles, parallelograms, and trapezoids to solve problems in authentic contexts.

HSG.GMD – Geometric Measurement & Dimension

Standard	Standard Statements (Jan 2021 Draft)
HSG.GMD.A.1	Solve authentic modeling problems using area formulas for triangles, parallelograms, trapezoids, regular polygons, and circles. (★)
HSG.GMD.A.3	Use geometric shapes, their measures, and their properties to describe real world objects, and solve related authentic modeling and design problems. (★)

HSG.MG – Modeling with Geometry

Standard	Standard Statements (Jan 2021 Draft)
HSG.MG.A.1	Use geometric shapes, their measures, and their properties to describe real world objects, and solve related modeling and design problems. (★) Integrated with Standard(s): HSG.MG.A.3
HSG.MG.A.2	Apply concepts of density based on area and volume in authentic modeling situations. (★)

6B: Remaining Geometry Considerations

The concepts listed in this table represent remaining content that is often taught in high school but should only be attended to if students demonstrate proficiency in priority content. The right-hand column contains considerations where this content could be included, integrated, or excluded as well as reference standards for the identified remaining concepts.

Concept	Core Alignment Consideration (January 2021 Draft)
Congruence Proofs	**Limit** work to applications of triangle congruence in modeling contexts. Reference Standard(s): HSG.CO.C.9
Additional Proofs	**Integrate** lessons of logical reasoning with applications of priority geometry content as needed to construct viable arguments (MP.3). **Reduce** emphasis on the two-column proof procedure, instead emphasizing using deductive reasoning to support conjectures.
Similarity transformations	**Combine** lessons using dilations and justification of similarity transformations to contrast and complement the focus on congruence and rigid motions. Reference Standard(s): HSG.SRT.A
Polynomial Theorem Proofs	**Limit** to justification of theorems of line relationships, angles, triangles, and parallelograms in modeling contexts. Reference Standard(s): HSG.CO.C.10, HSG.CO.C.11
Pythagorean Theorem	**Integrate** use of the Pythagorean Theorem in context with right triangle applications. **Eliminate** proofs of Pythagorean identities in the first three credits. Reference Standard(s): HSA.APR.C.4, HSF.TF.C.8, HSG.SRT.B.4, HSG.SRT.C.6
Law of Sines and Cosines	**Eliminate** lessons in the first two credit courses. **Reduced** emphasis fourth credit courses as applicable for advanced algebra options. Reference Standard(s): HSG.SRT.D.11
Visualize 2-D and 3-D relationships	**Eliminate** lessons on cross-sections and rotations of two-dimensional objects; Limit applications use of two-dimensional nets of three-dimensional polyhedra. Reference Standard(s): HSG.GMD.B.4
Conic Sections	**Limit** use of the Pythagorean theorem to develop and apply the distance formula and the equation of a circle. **Eliminate** lessons deriving formulas for equations of additional conic sections. Reference Standard(s): HSG.GPE.A.1, HSG.GPE.A.2

6C: High School Geometry Crosswalk with Clarifying Guidance

CLUSTER: HSG.CO – Congruence

STANDARD: HSG.CO.A.1

DRAFT Standards Statement (JAN 2021):

Definitions should include 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.

DRAFT Clarifying Guidance (JAN 2021):

Definitions should include 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.

M.P. Students need to attend to precision as they use definitions to discuss their reasoning with others.

Original CCSS Text (2010):

Use definitions of geometric figures and geometric relationships to justify the solutions of problems.

STANDARD: HSG.CO.A.5, HSG.CO.A.2, HSG.CO.A.4

DRAFT Standards Statement (JAN 2021):

Develop definitions of rotations, reflections, and translations in authentic contexts. Apply these definitions to transform a shape or map between two given shapes.

DRAFT Clarifying Guidance (JAN 2021):

The focus here is on rigid transformations (rotation, reflection, and translations) that create congruent figures. This includes the use of transformation rules and functions.

HS expectation would be for any rigid transformation. Use for a purpose with technology.

Original CCSS Text (2010):

(A.2) Represent transformations in the plane using, e.g., 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).

(A.4) Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

(A.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.

STANDARD: HSG.CO.B.7, HSG.CO.B.8

DRAFT Standards Statement (JAN 2021):

Apply and justify triangle congruence theorems in authentic contexts.

DRAFT Clarifying Guidance (JAN 2021):

Note: *B.8 will be left for a "+1" course. Rigid transformations are removed from this standard, but included as part of proposed HSG. CO.A.2, A.4, A.5 standard. Use of triangle congruence theorems (SSS, SAS, ASA, AAS, or HL) should be used to solve problems in authentic contexts.

The focus here is to develop an understanding of techniques for proving that two triangles are congruent. Opportunities should also be available for students to understand when the conditions do not result in congruence.

M.P. Construct viable arguments and critique the reasoning of others when showing that two triangular roof trusses must be congruent.

Original CCSS Text (2010):

(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.

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

STANDARD: HSG.CO.C.9, HSG.CO.C.10

DRAFT Standards Statement (JAN 2021):

Justify theorems of line relationships, angles, triangles, and parallelograms; and use them to solve problems in authentic contexts.

DRAFT Clarifying Guidance (JAN 2021):

Theorems should include angles formed by parallel lines, angles formed by polygons, properties of special quadrilaterals (sides, angles, and diagonals), and properties of special triangles (isosceles, equilateral, and right).

Justification should require a precise chain of reasoning that verifies the validity of a mathematical theorem.

M.P. Construct viable arguments and critique the reasoning of others when justifying the congruence of diagonals in a rectangle that is built by a contractor installing a rectangular window.

Original CCSS Text (2010):

(C.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.

(C.10) Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; 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.

STANDARD: HSG.CO.D.12

DRAFT Standards Statement (JAN 2021):

Perform geometric constructions with a variety of tools and methods.

DRAFT Clarifying Guidance (JAN 2021):

Tools to include compass and straightedge, string, reflective devices, paper folding, and/or dynamic geometric software. Constructions to include 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.

M.P. Use appropriate tools strategically when choosing the physical method and appropriate procedures for performing a construction.

Original CCSS Text (2010):

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.

CLUSTER: HSG.SRT – Similarity, Right Triangles, & Trigonometry

STANDARD: HSG.SRT.B.5, HSG.SRT.A.1, HSG.SRT.A.2, HSG.SRT.A.3

DRAFT Standards Statement (JAN 2021):

Use similarity theorems to determine whether two triangles are similar. Verify experimentally the properties of dilations given by a center and a scale factor. Solve problems in authentic contexts involving similar triangles or dilations.

DRAFT Clarifying Guidance (JAN 2021):

Triangles can be shown to be similar using transformations and triangle similarity theorems. Apply theorems of AA similarity, SSS similarity, and SAS similarity to prove that two given triangles are similar.

M.P. Model with Mathematics to use similarity to solve real world problems to measure lengths and distances indirectly.

Original CCSS Text (2010):

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

(A.1) Verify experimentally the properties of dilations given by a center and a scale factor:

HSG.SRT.A.1a 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.

HSG.SRT.A.1b The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

(A.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.

(A.3) Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

STANDARD: HSG.SRT.C.8, HSG.SRT.C.6, HSG.SRT.C.7

DRAFT Standards Statement (JAN 2021):

Apply sine, cosine, and tangent ratios, and the Pythagorean Theorem, to solve problems in authentic contexts.

DRAFT Clarifying Guidance (JAN 2021):

Applications should involve finding angle and side measures of right triangles.

Understand the relationship between the sine and cosine of complementary angles.

Original CCSS Text (2010):

*(C.8) Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.**

(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.

(C.7) Explain and use the relationship between the sine and cosine of complementary angles.

CLUSTER: HSG.GPE – Expressing Geometric Properties with Equations

STANDARD: HSG.GPE.A.1

DRAFT Standards Statement (JAN 2021):

Apply the Pythagorean Theorem in authentic contexts, and develop the standard form for the equation of a circle.

DRAFT Clarifying Guidance (JAN 2021):

Given the coordinates of the center and length of the radius, write the equation of the circle in standard form. Given the equation of a circle in standard form, determine the coordinates of its center and the length of its radius.

Use the Pythagorean Theorem to develop and apply the distance formula

M.P. Look for and make use of structure to make connections to the Pythagorean Theorem and distance formula.

Original CCSS Text (2010):

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.

STANDARD: HSG.GPE.B.4

DRAFT Standards Statement (JAN 2021):

Use Cartesian coordinates to determine parallel and perpendicular relationships, and distance in the coordinate plane.

DRAFT Clarifying Guidance (JAN 2021):

Applications include the use of coordinates to compute perimeters of polygons and areas of triangles and rectangles. The distance formula will play an important role in these applications.

M.P. Use appropriate tools strategically to choose between tools such as the slope formula, distance formula, midpoint formula, or Pythagorean Theorem.

Original CCSS Text (2010):

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, v3) lies on the circle centered at the origin and containing the point (0, 2).

STANDARD: HSG.GPE.B.5

DRAFT Standards Statement (JAN 2021):

Use the slopes of segments and the coordinates of the vertices of triangles, parallelograms, and trapezoids to solve problems in authentic contexts.

DRAFT Clarifying Guidance (JAN 2021):

Possible applications include using slopes to determine parallel sides in parallelograms and trapezoids, perpendicular diagonals in rhombuses, perpendicular sides in a rectangle, as well as verifying mid-segment properties in triangles and trapezoids. Use coordinates of vertices for lengths of sides and diagonals to classify quadrilaterals and triangles.

Original CCSS Text (2010):

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).

CLUSTER: HSG.GMD – Geometric Measurement & Dimension

STANDARD: HSG.GMD.A.1

DRAFT Standards Statement (JAN 2021):

Solve authentic modeling problems using area formulas for triangles, parallelograms, trapezoids, regular polygons, and circles.*

DRAFT Clarifying Guidance (JAN 2021):

Students should give informal arguments for area formulas, and combine them to solve problems with composite figures.

M.P. Model with Mathematics can be used here to solve a variety of problems involving area.

Original CCSS Text (2010):

Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. Use dissection arguments, Cavalieri's principle, and informal limit arguments.

STANDARD: HSG.GMD.A.3

DRAFT Standards Statement (JAN 2021):

Use volume and surface area formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems and apply to authentic contexts.

DRAFT Clarifying Guidance (JAN 2021):

Students should give informal arguments for area and volume formulas, and combine them to solve problems with composite figures. This standard is limited to right solids.

M.P. Make sense of problems and persevere in solving them when finding the volume of prisms and pyramids with regular polygon bases (possibly using trigonometry)

Original CCSS Text (2010):

*Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.**

CLUSTER: HSG.MG – Modeling with Geometry

STANDARD: HSG.MG.A.1, HSG.MG.A.3

DRAFT Standards Statement (JAN 2021):

Use geometric shapes, their measures, and their properties to describe real world objects, and solve related authentic modeling and design problems.

DRAFT Clarifying Guidance (JAN 2021):

This includes the use of volume formulas for prisms, cylinders, pyramids, cones, and spheres.

M.P. Model with Mathematics can be used here to solve a variety of problems such as designing a real world object with CAD design tools for 3D printing or CNC machining.

Original CCSS Text (2010):

*(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).**

*(A.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).**

STANDARD: HSG.MG.A.2

DRAFT Standards Statement (JAN 2021):

Apply concepts of density based on area and volume in authentic modeling situations.

DRAFT Clarifying Guidance (JAN 2021):

The focus is on geometric probability and proportional reasoning.

This should include an understanding of the ratios of areas (area ratio = (scale factor)^2) and volumes (volume ratio = (scale factor)^3) of similar figures.

M.P. Model with Mathematics to compute persons per square miles, BTUs per cubic foot, or specimens per acre.

Original CCSS Text (2010):

*Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).**