

Georgia Standards of Excellence Geometry



"Where Young Men Soar to Greater Heights"

Geometry is the second course in a sequence of three required high school courses designed to ensure career and college readiness. The course represents a discrete study of geometry with correlated statistics applications.

The standards in the three-course high school sequence specify the mathematics that all students should study in order to be college and career ready. Additional mathematics content is provided in fourth credit courses and advanced courses including pre-calculus, calculus, advanced statistics, discrete mathematics, and mathematics of finance courses. High school course content standards are listed by conceptual categories including Number and Quantity, Algebra, Functions, Geometry, and Statistics and Probability.

Conceptual categories portray a coherent view of high school mathematics content; a student's work with functions, for example, crosses a number of traditional course boundaries, potentially up through and including calculus. Standards for Mathematical Practice provide the foundation for instruction and assessment.

<https://www.georgiastandards.org/Georgia-Standards/Pages/Math.aspx>

**Unit 1: Transformations in the
Coordinate Plane**
2 – 3 weeks

Standards: MGSE9-12.G.CO.1, MGSE9-12.G.CO.2, MGSE9-12.G.CO.3, MGSE9-12.G.CO.4, MGSE9-12.G.CO.5

Concepts

- Perform transformations in the coordinate plane, describe a sequence of transformations that will map one figure onto another
- Compare transformations that preserve distance and angle to those that do not

Unit 3: Right Triangle Trigonometry
3-4 weeks

Standards: MGSE9-12.G.SRT.6, MGSE9-12.G.SRT.7, MGSE9-12.G.SRT.8

Concepts

- Apply similarity in right triangles to understand right triangle trigonometry
- Use the Pythagorean Theorem and the relationship between the sine and cosine of complementary angles to solve problems involving right triangles

Unit 5: Geometric and Algebraic Connections
4-5 weeks

Standards: MGSE9-12.G.GPE.1 MGSE9-12.G.GPE.4 MGSE9-12.G.GPE.5 MGSE9-12.G.GPE.6 MGSE9-12.G.GPE.7 MGSE9-12.G.MG.1 MGSE9-12.G.MG.2 MGSE9-12.G.MG.3

Concepts

- Verify algebraically geometric relationships of figures in the coordinate plane (triangles, quadrilaterals, and circles)
- Solve problems involving parallel and perpendicular lines, perimeters and areas of polygons, and the partitioning of a segment in a given ratio

Unit 2: Similarity, Congruence, and Proofs
9 – 10 weeks

Standards: MGSE9-12.G.SRT.1, MGSE9-12.G.SRT.2, MGSE9-12.G.SRT.3, MGSE9-12.G.SRT.4, MGSE9-12.G.SRT.5, MGSE9-12.G.CO.6, MGSE9-12.G.CO.7 MGSE9-12.G.CO.8, MGSE9-12.G.CO.9, MGSE9-12.G.CO.10, MGSE9-12.G.CO.11, MGSE9-12.G.CO.12 MGSE9-12.G.CO.13

Concepts

- Use transformations and proportional reasoning to develop an understanding of similarity and congruence
- Identify criteria for similarity and congruence of triangles, develop facility with geometric proofs

Unit 4: Circles and Volume
6 – 7 weeks

Standards: MGSE9-12.G.C.1 MGSE9-12.G.C.2 MGSE9-12.G.C.3 MGSE9-12.G.C.4 MGSE9-12.G.C.5 MGSE9-12.G.GMD.1 MGSE9-12.G.GMD.2 MGSE9-12.G.GMD.3 MGSE9-12.G.GMD.4

Concepts

- Understand and apply theorems about circles, find arc lengths of circles and areas of sectors of circles
- Develop and explain formulas of circles, the volume of solid figures and use formulas to solve problems
- Identifying cross-sections of three-dimensional shapes to identifying three-dimensional objects

Unit 6: Applications of Probability
4 – 5 weeks

Standards: MGSE9-12.S.CP.1 MGSE9-12.S.CP.2 MGSE9-12.S.CP.3 MGSE9-12.S.CP.4 MGSE9-12.S.CP.5 MGSE9-12.S.CP.6 MGSE9-12.S.CP.7

Concepts

- Understand independence and conditional probability and use them to interpret data
- Formalize the rules of probability and use the rules to compute probabilities of compound events

Georgia Standards of Excellence Geometry Mathematics

Unit 7: Show What We Know

2-3 weeks

Standards: All standards

Concepts

- Utilize Milestones EOC Study Guide
- Released Practice Assessments
- Mathematical Practices Project

These units were written to build upon concepts from prior units, so later units contain tasks that depend upon the concepts addressed in earlier units. All units will include the Mathematical Practices and indicate skills to maintain.

NOTE: Mathematical standards are interwoven and should be addressed throughout the year in as many different units and tasks as possible in order to stress the natural connections that exist among mathematical topics.

Grade 9-12 Key:

Number and Quantity Strand: RN = The Real Number System, Q = Quantities, CN = Complex Number System, VM = Vector and Matrix Quantities

Algebra Strand: SSE = Seeing Structure in Expressions, APR = Arithmetic with Polynomial and Rational Expressions, CED = Creating Equations, REI = Reasoning with Equations and Inequalities

Functions Strand: IF = Interpreting Functions, LE = Linear and Exponential Models, BF = Building Functions, TF = Trigonometric Functions

Geometry Strand: CO = Congruence, SRT = Similarity, Right Triangles, and Trigonometry, C = Circles, GPE = Expressing Geometric Properties with Equations, GMD = Geometric Measurement and Dimension, MG = Modeling with Geometry

Statistics and Probability Strand: ID = Interpreting Categorical and Quantitative Data, IC = Making Inferences and Justifying Conclusions, CP = Conditional Probability and the Rules of Probability, MD = Using Probability to Make Decisions

Georgia Standards of Excellence Geometry Mathematics

GSE GEOMETRY: An understanding of the attributes and relationships of geometric objects can be applied in diverse contexts— interpreting a schematic drawing, estimating the amount of wood needed to frame a sloping roof, rendering computer graphics, or designing a sewing pattern for the most efficient use of material.

Although the units in this instructional framework emphasize key standards and big ideas at specific times of the year, routine topics such as estimation, mental computation, and basic computation facts should be addressed on an ongoing basis. Ideas related to the eight practice standards should be addressed constantly as well. This unit provides much needed content information and excellent learning activities. However, the intent of the framework is not to provide a comprehensive resource for the implementation of all standards in the unit. A variety of resources should be utilized to supplement this unit. The tasks in this unit framework illustrate the types of learning activities that should be utilized from a variety of sources. To assure that this unit is taught with the appropriate emphasis, depth, and rigor, it is important that the “**Strategies for Teaching and Learning**” and the tasks listed under “**Evidence of Learning**” be reviewed early in the planning process.

Unit 1: Transformations in the Coordinate Plane

Unit Focus:

Unit 1: Building on standards from middle school, students will perform transformations in the coordinate plane, describe a sequence of transformations that will map one figure onto another, and describe transformations that will map a figure onto itself. Students will compare transformations that preserve distance and angle to those that do not.

In this unit students will:

- use and understand definitions of angles, circles, perpendicular lines, parallel lines, and line segments based on the undefined terms of point, line, distance along a line and length of an arc.
- describe and compare function transformations on a set of points as inputs to produce another set of points as outputs, including translations and horizontal or vertical stretching
- represent and compare rigid and size transformations of figures in a coordinate plane using various tools such as transparencies, geometry software, interactive whiteboards, waxed paper, tracing paper, mirrors and digital visual presenters.
- compare transformations that preserve size and shape versus those that do not.
- describe rotations and reflections of parallelograms, trapezoids or regular polygons that map each figure onto itself.
- develop and understand the meanings of rotation, reflection and translation based on angles, circles, perpendicular lines, parallel lines and line segments.
- transform a figure given a rotation, reflection or translation using graph paper, tracing paper, geometric software or other tools.
- create sequences of transformations that map a figure onto itself or to another figure.

Georgia Standards of Excellence Geometry Mathematics

Standards/Elements

KEY STANDARDS

Experiment with transformations in the plane

MGSE9–12.G.CO.1 Know precise definitions of 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.

MGSE9–12.G.CO.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).

MGSE9–12.G.CO.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.

MGSE9–12.G.CO.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.

MGSE9–12.G.CO.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.

STANDARDS FOR MATHEMATICAL PRACTICE

Refer to the Comprehensive Course Overview for more detailed information about the Standards for Mathematical Practice.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Additional Resources:

1. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryCurriculum-Map.pdf>
2. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryComprehensive-Course-Overview.pdf>
3. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/Geometry-Unit->

Georgia Standards of Excellence Geometry Mathematics

[1.pdf](#)

4. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryStandards.pdf>
5. <http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-EOC-Resources.aspx>
6. http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_GEOM_A_G_20161207.pdf
7. <https://www.usatestprep.com/member-login>
8. <https://www.ixl.com/math/geometry>

Geometry Resource Tools:

- [AAA Math: Geometry](#) : This site includes basic geometry facts and calculations, as well as instructions for calculating the area, perimeter, circumference, surface area, and volume of various shapes.
- [Class Zone](#) : Class Zone is a fantastic site for any geometry student. It covers proofs, basics of geometry, quadrilaterals, transformations, circles, surface area and volume, and much more.
- [Discovering Geometry](#) : Discovering Geometry has explanations, condensed lessons, practice sections, a guide specifically for parents, and student Web links.
- [edHelper.com](#) : Looking for free, printable geometry worksheets – with optional answer keys – for both middle school- and high school-level geometry? This site is the place for you!
- [Learning Math: Geometry](#) : The geometry of Learning Math has information for students and teachers. Video tutorials cover topics such as triangles, polygons, geometry basics, dissections and proofs, and the Pythagorean Theorem.
- [Math League](#) : The geometry section of this website is perfect for anyone desiring straightforward explanations for concepts under the following categories: basic terms, angles, figures and polygons, area and perimeter, coordinates and similar figures, and space figures and basic solids.
- [SparkNotes](#) contains everything you need to know about geometry proofs: terms, the structure of proofs, sample problems, and more.

Unit 2: Similarity, Congruence, and Proofs

Unit Focus:

Georgia Standards of Excellence Geometry Mathematics

Unit 2: Building on standards from Unit 1 and from middle school, students will use transformations and proportional reasoning to develop a formal understanding of similarity and congruence. Students will identify criteria for similarity and congruence of triangles, develop facility with geometric proofs (variety of formats), and use the concepts of similarity and congruence to prove theorems involving lines, angles, triangles, and other polygons

In this unit students will:

- verify experimentally with dilations in the coordinate plane
- use the idea of dilation transformations to develop the definition of similarity
- determine whether two figures are similar
- use the properties of similarity transformations to develop the criteria for proving similar triangles
- use AA, SAS, SSS similarity theorems to prove triangles are similar
- use triangle similarity to prove other theorems about triangles
- using similarity theorems to prove that two triangles are congruent
- prove geometric figures, other than triangles, are similar and/or congruent
- use descriptions of rigid motion and transformed geometric figures to predict the effects rigid motion has on figures in the coordinate plane
- know that rigid transformations preserve size and shape or distance and angle; use this fact to connect the idea of congruency and develop the definition of congruent
- use the definition of congruence, based on rigid motion, to show two triangles are congruent if and only if their corresponding sides and corresponding angles are congruent
- use the definition of congruence, based on rigid motion, to develop and explain the triangle congruence criteria; ASA, SSS, and SAS
- prove theorems pertaining to lines and angles
- prove theorems pertaining to triangles
- prove theorems pertaining to parallelograms
- make formal geometric constructions with a variety of tools and methods
- construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle

Standards/Elements

KEY STANDARDS

[Understand similarity in terms of similarity transformations](#)

MGSE9-12.G.SRT.1 Verify experimentally the properties of dilations given by a center and a scale factor.

- a. The dilation of a line not passing through the center of the dilation results in a parallel line and leaves a line passing through the center unchanged.

Georgia Standards of Excellence Geometry Mathematics

b. The dilation of a line segment is longer or shorter according to the ratio given by the scale factor.

MGSE9-12.G.SRT.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.

MGSE9-12.G.SRT.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Prove theorems involving similarity

MGSE9-12.G.SRT.4 Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, (and its converse); the Pythagorean Theorem using triangle similarity.

MGSE9-12.G.SRT.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Understand congruence in terms of rigid motions

MGSE9-12.G.CO.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.

MGSE9-12.G.CO.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.

MGSE9-12.G.CO.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. (Extend to include HL and AAS.)

Prove geometric theorems

MGSE9-12.G.CO.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.

MGSE9-12.G.CO.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.

MGSE9-12.G.CO.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

Make geometric constructions

MGSE9-12.G.CO.12 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

Georgia Standards of Excellence Geometry Mathematics

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.

MGSE9-12.G.CO.13 Construct an equilateral triangle, a square, and a regular hexagon, each inscribed in a circle.

STANDARDS FOR MATHEMATICAL PRACTICE

Refer to the Comprehensive Course Overview for more detailed information about the Standards for Mathematical Practice.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

SMP = Standards for Mathematical Practice

*Although the language of mathematical argument and justification is not explicitly expressed in the standards, it is embedded in the Standards for Mathematical Practice (3. Construct viable arguments and critique the reasoning of others.). Using conjecture, inductive reasoning, deductive reasoning, counterexamples and multiple methods of proof as appropriate is relevant to this and future units. Also, understanding the relationship between a statement and its converse, inverse and contrapositive is important.

Additional Resources:

1. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryCurriculum-Map.pdf>
2. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryComprehensive-Course-Overview.pdf>
3. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/Geometry-Unit-2.pdf>
4. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryStandards.pdf>
5. <http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-EOC-Resources.aspx>
6. <http://www.gadoe.org/Curriculum-Instruction-and->

Georgia Standards of Excellence Geometry Mathematics

[Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM GEOM A G 20161207.pdf](https://www.usatestprep.com/member-login)

7. <https://www.usatestprep.com/member-login>
8. <https://www.ixl.com/math/geometry>

Geometry Resource Tools:

- [AAA Math: Geometry](#) : This site includes basic geometry facts and calculations, as well as instructions for calculating the area, perimeter, circumference, surface area, and volume of various shapes.
- [Class Zone](#) : Class Zone is a fantastic site for any geometry student. It covers proofs, basics of geometry, quadrilaterals, transformations, circles, surface area and volume, and much more.
- [Discovering Geometry](#) : Discovering Geometry has explanations, condensed lessons, practice sections, a guide specifically for parents, and student Web links.
- [edHelper.com](#) : Looking for free, printable geometry worksheets – with optional answer keys – for both middle school- and high school-level geometry? This site is the place for you!
- [Learning Math: Geometry](#) : The geometry of Learning Math has information for students and teachers. Video tutorials cover topics such as triangles, polygons, geometry basics, dissections and proofs, and the Pythagorean Theorem.
- [Math League](#) : The geometry section of this website is perfect for anyone desiring straightforward explanations for concepts under the following categories: basic terms, angles, figures and polygons, area and perimeter, coordinates and similar figures, and space figures and basic solids.
- [SparkNotes](#) contains everything you need to know about geometry proofs: terms, the structure of proofs, sample problems, and more.

Unit 3: Right Triangle Trigonometry

Unit Focus:

Unit 3: Students will apply similarity in right triangles to understand right triangle trigonometry. Students will use the Pythagorean Theorem and the relationship between the sine and cosine of complementary angles to solve problems involving right triangles.

In this unit students will:

- explore the relationships that exist between sides and angles of right triangles
- build upon their previous knowledge of similar triangles and of the Pythagorean Theorem to determine the side length ratios in special right triangles
- understand the conceptual basis for the functional ratios sine and cosine
- explore how the values of these trigonometric functions relate in complementary angles
- to use trigonometric ratios to solve problems
- develop the skills and understanding needed for the study of many technical areas

Georgia Standards of Excellence Geometry Mathematics

- build a strong foundation for future study of trigonometric functions of real numbers

Although the units in this instructional framework emphasize key standards and big ideas at specific times of the year, routine topics such as estimation, mental computation, and basic computation facts should be addressed on an ongoing basis. Ideas related to the eight practice standards should be addressed constantly as well. This unit provides much needed content information and excellent learning activities. However, the intent of the framework is not to provide a comprehensive resource for the implementation of all standards in the unit. A variety of resources should be utilized to supplement this unit. The tasks in this unit framework illustrate the types of learning activities that should be utilized from a variety of sources. To assure that this unit is taught with the appropriate emphasis, depth, and rigor, it is important that the “**Strategies for Teaching and Learning**” in the Comprehensive Course Overview and the tasks listed under “**Evidence of Learning**” be reviewed early in the planning process.

Standards/Elements

KEY STANDARDS

Define trigonometric ratios and solve problems involving right triangles.

Define trigonometric ratios and solve problems involving right triangles

MGSE9-12.G.SRT.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.

MGSE9-12.G.SRT.7 Explain and use the relationship between the sine and cosine of complementary angles.

MGSE9-12.G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

STANDARDS FOR MATHEMATICAL PRACTICE

Refer to the Comprehensive Course Overview for more detailed information about the Standards for Mathematical Practice (SMP).

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning

Additional Resources:

Georgia Standards of Excellence Geometry Mathematics

1. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryCurriculum-Map.pdf>
2. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryComprehensive-Course-Overview.pdf>
3. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/Geometry-Unit-3.pdf>
4. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryStandards.pdf>
5. <http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-EOC-Resources.aspx>
6. http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_GEOM_A_G_20161207.pdf
7. <https://www.usatestprep.com/member-login>
8. <https://www.ixl.com/math/geometry>

Geometry Resource Tools:

- [AAA Math: Geometry](#) : This site includes basic geometry facts and calculations, as well as instructions for calculating the area, perimeter, circumference, surface area, and volume of various shapes.
- [Class Zone](#) : Class Zone is a fantastic site for any geometry student. It covers proofs, basics of geometry, quadrilaterals, transformations, circles, surface area and volume, and much more.
- [Discovering Geometry](#) : Discovering Geometry has explanations, condensed lessons, practice sections, a guide specifically for parents, and student Web links.
- [edHelper.com](#) : Looking for free, printable geometry worksheets – with optional answer keys – for both middle school- and high school-level geometry? This site is the place for you!
- [Learning Math: Geometry](#) : The geometry of Learning Math has information for students and teachers. Video tutorials cover topics such as triangles, polygons, geometry basics, dissections and proofs, and the Pythagorean Theorem.
- [Math League](#) : The geometry section of this website is perfect for anyone desiring straightforward explanations for concepts under the following categories: basic terms, angles, figures and polygons, area and perimeter, coordinates and similar figures, and space figures and basic solids.
- [SparkNotes](#) contains everything you need to know about geometry proofs: terms, the structure of proofs, sample problems, and more.

Georgia Standards of Excellence Geometry Mathematics

Unit 4: Circles and Volume

Unit Focus:

Unit 4: Students will understand and apply theorems about circles, find arc lengths of circles, and find areas of sectors of circles. Students will develop and explain formulas related to circles and the volume of solid figures and use the formulas to solve problems. Building on standards from middle school, students will extend the study of identifying cross-sections of three-dimensional shapes to identifying three-dimensional objects generated by rotations of two-dimensional objects

In this unit students will:

- Understand and Apply theorems about circles
- Find Arc Length and Area of Sectors of circles
- Explain Volume Formulas and Use them to solve problems

Although the units in this instructional framework emphasize key standards and big ideas at specific times of the year, routine topics such as estimation, mental computation, and basic computation facts should be addressed on an ongoing basis. Ideas related to the eight practice standards should be addressed constantly as well.

This unit provides much needed content information and excellent learning activities. However, the intent of the framework is not to provide a comprehensive resource for the implementation of all standards in the unit. A variety of resources should be utilized to supplement this unit. The tasks in this unit framework illustrate the types of learning activities that should be utilized from a variety of sources. To assure that this unit is taught with the appropriate emphasis, depth, and rigor, it is important that the “**Strategies for Teaching and Learning**” in the Comprehensive Course Overview and the tasks listed under “**Evidence of Learning**” be reviewed early in the planning process.

Standards/Elements

KEY STANDARDS

[Understand and apply theorems about circles](#)

MGSE9-12.G.C.1 Understand that all circles are similar.

MGSE9-12.G.C.2 Identify and describe relationships among inscribed angles, radii, chords, tangents, and secants. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

MGSE9-12.G.C.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

MGSE9-12.G.C.4 Construct a tangent line from a point outside a given circle to the circle.

Georgia Standards of Excellence Geometry Mathematics

Find arc lengths and areas of sectors of circles

MGSE9-12.G.C.5 Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

Explain volume formulas and use them to solve problems

MGSE9-12.G.GMD.1 Give informal arguments for geometric formulas.

- a. Give informal arguments for the formulas of the circumference of a circle and area of a circle using dissection arguments and informal limit arguments.
- b. Give informal arguments for the formula of the volume of a cylinder, pyramid, and cone using Cavalieri's principle.

MGSE9-12.G.GMD.2 Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

MGSE9-12.G.GMD.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Visualize relationships between two-dimensional and three-dimensional objects

MGSE9-12.G.GMD.4 Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

STANDARDS FOR MATHEMATICAL PRACTICE

Refer to the Comprehensive Course Overview for more detailed information about the Standards for Mathematical Practice.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Additional Resources:

1. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryCurriculum-Map.pdf>

Georgia Standards of Excellence Geometry Mathematics

2. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryComprehensive-Course-Overview.pdf>
3. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/Geometry-Unit-4.pdf>
4. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryStandards.pdf>
5. <http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-EOC-Resources.aspx>
6. http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_GEOM_A_G_20161207.pdf
7. <https://www.usatestprep.com/member-login>
8. <https://www.ixl.com/math/geometry>

Geometry Resource Tools:

- [AAA Math: Geometry](#) : This site includes basic geometry facts and calculations, as well as instructions for calculating the area, perimeter, circumference, surface area, and volume of various shapes.
- [Class Zone](#) : Class Zone is a fantastic site for any geometry student. It covers proofs, basics of geometry, quadrilaterals, transformations, circles, surface area and volume, and much more.
- [Discovering Geometry](#) : Discovering Geometry has explanations, condensed lessons, practice sections, a guide specifically for parents, and student Web links.
- [edHelper.com](#) : Looking for free, printable geometry worksheets – with optional answer keys – for both middle school- and high school-level geometry? This site is the place for you!
- [Learning Math: Geometry](#) : The geometry of Learning Math has information for students and teachers. Video tutorials cover topics such as triangles, polygons, geometry basics, dissections and proofs, and the Pythagorean Theorem.
- [Math League](#) : The geometry section of this website is perfect for anyone desiring straightforward explanations for concepts under the following categories: basic terms, angles, figures and polygons, area and perimeter, coordinates and similar figures, and space figures and basic solids.
- [SparkNotes](#) contains everything you need to know about geometry proofs: terms, the structure of proofs, sample problems, and more.

Unit 5: Geometric and Algebraic Connections

Unit Focus:

Unit 5: Students will use the concepts of distance, midpoint, and slope to verify algebraically geometric relationships of figures in the coordinate plane (triangles, quadrilaterals, and circles). Students will solve

Georgia Standards of Excellence Geometry Mathematics

problems involving parallel and perpendicular lines, perimeters and areas of polygons, and the partitioning of a segment in a given ratio. Students will derive the equation of a circle and model realworld objects using geometric shapes and concepts.

In this unit students will:

- prove the slope relationship that exists between parallel lines and between perpendicular lines and then use those relationships to write the equations of lines □ extend the Pythagorean Theorem to the coordinate plane
- develop and use the formulas for the distance between two points and for finding the point that partitions a line segment in a given ratio
- revisit definitions of polygons while using slope and distance on the coordinate plane
- use coordinate algebra to determine perimeter and area of defined figures
- use Algebra to model Geometric ideas
- spend time developing equations from geometric definition of circles
- address equations in standard and general forms
- graph by hand and by using graphing technology
- develop the idea of algebraic proof in conjunction with writing formal geometric proofs.

Although the units in this instructional framework emphasize key standards and big ideas at specific times of the year, routine topics such as estimation, mental computation, and basic computation facts should be addressed on an ongoing basis. Ideas related to the eight practice standards should be addressed constantly as well. This unit provides much needed content information and excellent learning activities. However, the intent of the framework is not to provide a comprehensive resource for the implementation of all standards in the unit. A variety of resources should be utilized to supplement this unit. The tasks in this unit framework illustrate the types of learning activities that should be utilized from a variety of sources. To assure that this unit is taught with the appropriate emphasis, depth, and rigor, it is important that the “**Strategies for Teaching and Learning**” and the tasks listed under “**Evidence of Learning**” be reviewed early in the planning process.

Standards/Elements

KEY STANDARDS

[Translate between the geometric description and the equation for a conic section](#)

MGSE9-12.G.GPE.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.

[Use coordinates to prove simple geometric theorems algebraically](#)

MGSE9-12.G.GPE.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 $(0,2)$. (Focus on quadrilaterals, right triangles, and circles.)

Georgia Standards of Excellence Geometry Mathematics

MGSE9-12.G.GPE.5 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).

MGSE9-12.G.GPE.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

MGSE9-12.G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Apply geometric concepts in modeling situations

MGSE9-12.G.MG.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)

MGSE9-12.G.MG.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot)

MGSE9-12.G.MG.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).

STANDARDS FOR MATHEMATICAL PRACTICE

Refer to the Comprehensive Course Overview for more detailed information about the Standards for Mathematical Practice.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning

Additional Resources:

1. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryCurriculum-Map.pdf>
2. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryComprehensive-Course-Overview.pdf>
3. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/Geometry-Unit-5.pdf>
4. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryStandards.pdf>
5. <http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-EOC-Resources.aspx>

Georgia Standards of Excellence Geometry Mathematics

6. http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_GEOM_A_G_20161207.pdf
7. <https://www.usatestprep.com/member-login>
8. <https://www.ixl.com/math/geometry>

Geometry Resource Tools:

- [AAA Math: Geometry](#) : This site includes basic geometry facts and calculations, as well as instructions for calculating the area, perimeter, circumference, surface area, and volume of various shapes.
- [Class Zone](#) : Class Zone is a fantastic site for any geometry student. It covers proofs, basics of geometry, quadrilaterals, transformations, circles, surface area and volume, and much more.
- [Discovering Geometry](#) : Discovering Geometry has explanations, condensed lessons, practice sections, a guide specifically for parents, and student Web links.
- [edHelper.com](#) : Looking for free, printable geometry worksheets – with optional answer keys – for both middle school- and high school-level geometry? This site is the place for you!
- [Learning Math: Geometry](#) : The geometry of Learning Math has information for students and teachers. Video tutorials cover topics such as triangles, polygons, geometry basics, dissections and proofs, and the Pythagorean Theorem.
- [Math League](#) : The geometry section of this website is perfect for anyone desiring straightforward explanations for concepts under the following categories: basic terms, angles, figures and polygons, area and perimeter, coordinates and similar figures, and space figures and basic solids.
- [SparkNotes](#) contains everything you need to know about geometry proofs: terms, the structure of proofs, sample problems, and more.

Unit 6: Applications of Probability

Unit Focus:

Unit 6: Students will understand independence and conditional probability and use them to interpret data. Building on standards from middle school, students will formalize the rules of probability and use the rules to compute probabilities of compound events in a uniform probability model.

In this unit, students will:

- take their previously acquired knowledge of probability for simple and compound events and expand that to include conditional probabilities (events that depend upon and interact with other events) and independence.

Georgia Standards of Excellence Geometry Mathematics

- be exposed to elementary set theory and notation (sets, subsets, intersection and unions).
- use their knowledge of conditional probability and independence to make determinations on whether or not certain variables are independent.

Although the units in this instructional framework emphasize key standards and big ideas at specific times of the year, routine topics such as estimation, mental computation, and basic computation facts should be addressed on an ongoing basis. Ideas related to the eight practice standards should be addressed constantly as well.

Standards/Elements

KEY STANDARDS

[Understand independence and conditional probability and use them to interpret data](#)

MGSE9-12.S.CP.1 Describe categories of events as subsets of a sample space using unions, intersections, or complements of other events (or, and, not).

MGSE9-12.S.CP.2 Understand that if two events A and B are independent, the probability of A and B occurring together is the product of their probabilities, and that if the probability of two events A and B occurring together is the product of their probabilities, the two events are independent.

MGSE9-12.S.CP.3 Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$. Interpret independence of A and B in terms of conditional probability; that is, the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.

MGSE9-12.S.CP.4 Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, use collected data from a random sample of students in your school on their favorite subject among math, science, and English.*

Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.

MGSE9-12.S.CP.5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.

[Use the rules of probability to compute probabilities of compound events in a uniform probability model](#)

MGSE9-12.S.CP.6 Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in context.

MGSE9-12.S.CP.7 Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answers in context.

RELATED STANDARDS

[Investigate chance processes and develop, use, and evaluate probability models.](#)

Georgia Standards of Excellence Geometry Mathematics

MGSE7.SP.5 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around $\frac{1}{2}$ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

MGSE7.SP.8a Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.

MGSE7.SP.8b Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.

STANDARDS FOR MATHEMATICAL PRACTICE

Refer to the Comprehensive Course Overview for more detailed information about the Standards for Mathematical Practice (SMP).

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Additional Resources:

1. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryCurriculum-Map.pdf>
2. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryComprehensive-Course-Overview.pdf>
3. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/Geometry-Unit-6.pdf>
4. <https://www.georgiastandards.org/Georgia-Standards/Frameworks/GeometryStandards.pdf>
5. <http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-EOC-Resources.aspx>
6. http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_GEOM_A_G_20161207.pdf
7. <https://www.usatestprep.com/member-login>

Georgia Standards of Excellence Geometry Mathematics

8. <https://www.ixl.com/math/geometry>

Geometry Resource Tools:

- [AAA Math: Geometry](#) : This site includes basic geometry facts and calculations, as well as instructions for calculating the area, perimeter, circumference, surface area, and volume of various shapes.
- [Class Zone](#) : Class Zone is a fantastic site for any geometry student. It covers proofs, basics of geometry, quadrilaterals, transformations, circles, surface area and volume, and much more.
- [Discovering Geometry](#) : Discovering Geometry has explanations, condensed lessons, practice sections, a guide specifically for parents, and student Web links.
- [edHelper.com](#) : Looking for free, printable geometry worksheets – with optional answer keys – for both middle school- and high school-level geometry? This site is the place for you!
- [Learning Math: Geometry](#) : The geometry of Learning Math has information for students and teachers. Video tutorials cover topics such as triangles, polygons, geometry basics, dissections and proofs, and the Pythagorean Theorem.
- [Math League](#) : The geometry section of this website is perfect for anyone desiring straightforward explanations for concepts under the following categories: basic terms, angles, figures and polygons, area and perimeter, coordinates and similar figures, and space figures and basic solids.
- [SparkNotes](#) contains everything you need to know about geometry proofs: terms, the structure of proofs, sample problems, and more.

Unit 7: Show What We Know

Unit Focus:

ALL

Standards/Elements:

ALL priority standards should be reviewed

- Review and Reteach all content standards (USA Testprep, State Study Guides, etc.)
- Apply skills and concepts learned from all units
- Engage in problem-based learning/project
- Demonstrate mastery using summative assessments
- Preview the Unit 1 content for the upcoming grade level

Additional Resources:

Georgia Standards of Excellence Geometry Mathematics

1. <http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-EOC-Resources.aspx>
2. http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Assessment%20Guides/GM_GEOM_A_G_20161207.pdf
3. <https://www.usatestprep.com/member-login>
4. <https://www.ixl.com/math/geometry>

Geometry Resource Tools:

- [AAA Math: Geometry](#) : This site includes basic geometry facts and calculations, as well as instructions for calculating the area, perimeter, circumference, surface area, and volume of various shapes.
- [Class Zone](#) : Class Zone is a fantastic site for any geometry student. It covers proofs, basics of geometry, quadrilaterals, transformations, circles, surface area and volume, and much more.
- [Discovering Geometry](#) : Discovering Geometry has explanations, condensed lessons, practice sections, a guide specifically for parents, and student Web links.
- [edHelper.com](#) : Looking for free, printable geometry worksheets – with optional answer keys – for both middle school- and high school-level geometry? This site is the place for you!
- [Learning Math: Geometry](#) : The geometry of Learning Math has information for students and teachers. Video tutorials cover topics such as triangles, polygons, geometry basics, dissections and proofs, and the Pythagorean Theorem.
- [Math League](#) : The geometry section of this website is perfect for anyone desiring straightforward explanations for concepts under the following categories: basic terms, angles, figures and polygons, area and perimeter, coordinates and similar figures, and space figures and basic solids.
- [SparkNotes](#) contains everything you need to know about geometry proofs: terms, the structure of proofs, sample problems, and more.