



Mathematics Curriculum

Geometry

Course Description

This course in geometry is designed to help the student to do the following: Understand the basic structure of Euclidean geometry; develop spatial visualization while building the knowledge of the relationships among geometric elements; grow in understanding of the deductive method; appreciate need for precision of language; use and strengthen algebraic skills.

Essentials of Geometry

PA Standards

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.7 - Apply trigonometric ratios to solve problems involving right triangles.

CC.2.3.HS.A.8 - Apply Geometric theorems to verify properties of circles.

CC.2.3.HS.A.9 - Extend the concept of similarity to determine arc lengths and areas of sectors of circles.

CC.2.3.HS.A.11 - Apply coordinate geometry to prove simple geometric theorems algebraically.

CC.2.3.HS.A.13 - Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

CC.2.2.HS.C.9 - Prove the Pythagorean identity and use it to calculate trigonometric ratios.

Expectations for Students

- Name and sketch geometric figures
- Identify points, lines, and planes
- Use segment postulates to identify congruent segments
- Use segments and congruence
- Solve for lengths of segments in the coordinate plane
- Use the Pythagorean Theorem
- Name and measure line segments
- Use midpoint and distance formulas
- Name, measure, and classify angles
- Identify congruent angles
- Describe angle pair relationships to find angle measures

- Use angle postulates to measure and classify angles
- Classify polygons
- Find perimeter, circumference, and area
- Find dimensions of polygons
- Estimate distances between points on the coordinate plane
- Problem solving and using geometry terms in the real world

Reasoning and Proof

PA Standards

CC.2.3.HS.A.1 - Use geometric figures and their properties to represent transformations in the plane.

CC.2.3.HS.A.2 - Apply rigid transformations to determine and explain congruence.

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.6 - Verify and apply theorems involving similarity as they relate to plane figures.

CC.2.3.HS.A.8 - Apply Geometric theorems to verify properties of circles.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

Expectations for Students

- Use inductive reasoning
- Describe and solve patterns
- Write mathematical conjectures
- Analyze conditional, converse, inverse, contrapositive, and bi-conditional statements
- Apply deductive reasoning
- Write two-column proofs using geometric theorems
- Use postulates and diagrams that involve angle and segment measurements
- Reason using properties from Algebra to form logical arguments
- Prove statements about segments and angles
- Identify and prove angle pair relationships
- Problem solve with real-world situations

Parallel and Perpendicular Lines

PA Standards

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.11 - Apply coordinate geometry to prove simple geometric theorems algebraically.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real world problems.

Expectations for Students

- Identify and solve angle pairs formed by two intersecting lines
- Identify and solve angle pairs formed by three intersecting lines
- Identify and solve angle pairs formed by parallel lines and a transversal
- Use angle relationships to prove lines are parallel
- Solve and compare slopes of lines
- Write and graph equations of lines
- Write equation of lines that are parallel
- Write equation of lines that are perpendicular
- Find the distance between two points on the coordinate plane
- Find the distance between a point and a line
- Problem solve with real-world situations

Congruent Triangles

PA Standards

CC.2.3.HS.A.1 - Use geometric figures and their properties to represent transformations in the plane.

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.4 - Apply the concept of congruence to create geometric constructions.

CC.2.3.HS.A.5 - Create justifications based on transformations to establish similarity of plane figures.

CC.2.3.HS.A.6 - Verify and apply theorems involving similarity as they relate to plane figures.

CC.2.3.HS.A.7 - Apply trigonometric ratios to solve problems involving right triangles.

CC.2.3.HS.A.11 - Apply coordinate geometry to prove simple geometric theorems algebraically.

CC.2.3.HS.A.13 - Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

CC.2.2.HS.C.9 - Prove the Pythagorean identity and use it to calculate trigonometric ratios.

Expectations for Students

- Classify sides and angles of a triangle
- Classify sides of a triangle on the coordinate plane
- Find the perimeter of a triangle on the coordinate plane
- Solve the interior angles of a triangle
- Solve the exterior angles of a triangle
- Solve angles of a right triangle
- Learn properties of congruent triangles
- Apply theorems of congruent triangles
- Prove triangles congruent by side, side, side (SSS)
- Prove Triangles are congruent on the coordinate plane
- Prove triangles congruent by side, angle, side (SAS) and hypotenuse, leg (HL)
- Prove triangles congruent by angle, side, angle (ASA) and angle, angle, side (AAS)
- Write two-column proofs proving triangles are congruent
- Use congruent triangles to prove corresponding parts are congruent
- Solve for angle measurements using isosceles and equilateral triangles theorems
- Problem solve with real-world situations

Relationships Within Triangles

PA Standards

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.9 - Extend the concept of similarity to determine arc lengths and areas of sectors of circles.

CC.2.3.HS.A.11 - Apply coordinate geometry to prove simple geometric theorems algebraically.

CC.2.3.HS.A.13 - Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

CC.2.2.HS.C.9 - Prove the Pythagorean identity and use it to calculate trigonometric ratios.

Expectations for Students

- Prove the midsegment theorem of a triangle
- Solve and identify perpendicular bisector theorems for triangles
- Solve and identify angle bisector theorems for triangles
- Use the angle bisector to find distance relationships
- Find the medians and altitudes of triangles
- Use properties of Inequalities in a Triangle to estimate side and angle measurements
- Use the Hinge Theorem to describe the restrictions for side lengths or angle measurements.
- Problem solve with real-world situations

Surface Area and Volume of Solids

PA Standards

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.4 - Apply the concept of congruence to create geometric constructions.

CC.2.3.HS.A.6 - Verify and apply theorems involving similarity as they relate to plane figures.

CC.2.3.HS.A.8 - Apply Geometric theorems to verify properties of circles.

CC.2.3.HS.A.9 - Extend the concept of similarity to determine arc lengths and areas of sectors of circles.

CC.2.3.HS.A.10 - Translate between the geometric description and the equation for a conic section.

CC.2.3.HS.A.12 - Explain volume formulas and use them to solve problems.

CC.2.3.HS.A.13 - Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

CC.2.2.HS.C.9 - Prove the Pythagorean identity and use it to calculate trigonometric ratios.

Expectations for Students

- Find the areas of triangles and parallelograms
- Solve areas of trapezoids, rhombuses, and kites
- Draw-three dimensional figures
- Identify and explore solids
- Solve surface area of prisms and cylinders
- Solve surface area of pyramids and cones
- Solve volume of prisms and cylinders
- Solve volume of pyramids and cones
- Solve surface area and volume of spheres
- Explore similar solids
- Problem solve with real-world situations

Similarity

PA Standards

CC.2.3.HS.A.1 - Use geometric figures and their properties to represent transformations in the plane.

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.4 - Apply the concept of congruence to create geometric constructions.

CC.2.3.HS.A.5 - Create justifications based on transformations to establish similarity of plane figures.

CC.2.3.HS.A.6 - Verify and apply theorems involving similarity as they relate to plane figures.

CC.2.3.HS.A.11 - Apply coordinate geometry to prove simple geometric theorems algebraically.

CC.2.3.HS.A.13 - Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

CC.2.2.HS.C.9 - Prove the Pythagorean identity and use it to calculate trigonometric ratios.

Expectations for Students

- Simplify and write ratios
- Solve problems by writing ratios into proportions
- Determine the Geometric Mean
- Create proportions to solve geometry problems
- Use proportions to identify similar polygons
- Prove triangles are similar by angle, angle (AA), SSS and SAS
- Use proportions with similar triangles
- Problem solve with real-world situations

Quadrilaterals

PA Standards

CC.2.3.HS.A.1 - Use geometric figures and their properties to represent transformations in the plane.

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.4 - Apply the concept of congruence to create geometric constructions.

CC.2.3.HS.A.5 - Create justifications based on transformations to establish similarity of plane figures.

CC.2.3.HS.A.6 - Verify and apply theorems involving similarity as they relate to plane figures.

CC.2.3.HS.A.9 - Extend the concept of similarity to determine arc lengths and areas of sectors of circles.

CC.2.3.HS.A.11 - Apply coordinate geometry to prove simple geometric theorems algebraically.

CC.2.3.HS.A.13 - Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

Expectations for Students

- Establish the classifications of polygons
- Find the interior and exterior angle measures in polygons
- Develop the properties of parallelograms
- Discover the theorems for angles and sides of a parallelogram
- Show by proving on the coordinate plane that a quadrilateral is a parallelogram
- Discover and use properties of rhombuses, rectangles, and squares
- Show by proving on the coordinate plane that a quadrilateral is a parallelogram and then prove if it is a rhombus, rectangle, or square
- Discover and use properties of trapezoids and kites
- Solve for isosceles trapezoids
- Use and prove the midsegment of a trapezoid
- Show by proving on the coordinate plane that a quadrilateral is a trapezoid or kite
- Identify special quadrilaterals
- Use the coordinate plane to prove the specific type of quadrilateral
- Problem solve with real-world situations

Right Triangles and Trigonometry

PA Standards

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.7 - Apply trigonometric ratios to solve problems involving right triangles.

CC.2.3.HS.A.13 - Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

CC.2.2.HS.C.9 - Prove the Pythagorean identity and use it to calculate trigonometric ratios.

Expectations for Students

- Apply the Pythagorean theorem
- Formulate Pythagorean Triples
- Use the converse of the Pythagorean Theorem to prove right triangles
- Classify triangles angles by the three side lengths
- Identify the altitudes of a triangle
- Use similar right triangles and sketch
- Solve segment lengths by using similar right triangles
- Use the theorems for special right triangles to solve for sides and angles
- Apply the tangent, sine, and cosine ratios to solve for side lengths
- Apply the inverse tangent, sine, and cosine ratios to solve for angle measurements
- Problem solve with real-world situations

Properties of Circles

PA Standards

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.8 - Apply Geometric theorems to verify properties of circles.

CC.2.3.HS.A.9 - Extend the concept of similarity to determine arc lengths and areas of sectors of circles.

CC.2.3.HS.A.13 - Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

CC.2.2.HS.C.9 - Prove the Pythagorean identity and use it to calculate trigonometric ratios.

Expectations for Students

- Solve for the circumference and area of circles
- Find lengths in circles in a coordinate plane
- Use Properties of Tangents to solve for angles and segments
- Find arc measures
- Identify arcs, congruent arcs and congruent circles
- Use congruent chords to find an arc measurement
- Apply Properties of Chords
- Use Inscribed Angles and Polygons to solve for angles and arc measurements
- Find the measure of an intercepted arc
- Use inscribed polygons and circumscribed circles to solve for angle measurements
- Apply and find angle measurements inside and outside a circle
- Find segment lengths in circles
- Write and graph equations of circles
- Problem solve with real-world situations

Measuring Length and Area

PA Standards

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.8 - Apply Geometric theorems to verify properties of circles.

CC.2.3.HS.A.9 - Extend the concept of similarity to determine arc lengths and areas of sectors of circles.

CC.2.3.HS.A.13 - Analyze relationships between two-dimensional and three-dimensional objects.

CC.2.3.HS.A.14 - Apply geometric concepts to model and solve real-world problems.

Expectations for Students

- Find the ratios of similar polygons
- Find the perimeter and area of similar figures
- Use the circumference to find the distance traveled
- Find arc length
- Use arc lengths to find measures and distances
- Solve for the area of circles and sectors • Find the measure of the central angle
- Find the perimeter and area of regular polygons inscribed in a circle
- Use lengths and segments to find the geometric probability
- Use area to find the geometric probability
- Problem solve with real-world situations

Properties of Transformations

PA Standards

CC.2.3.HS.A.1 - Use geometric figures and their properties to represent transformations in the plane.

CC.2.3.HS.A.2 - Apply rigid transformations to determine and explain congruence.

CC.2.3.HS.A.3 - Verify and apply geometric theorems as they relate to geometric figures.

CC.2.3.HS.A.4 - Apply the concept of congruence to create geometric constructions.

CC.2.3.HS.A.5 - Create justifications based on transformations to establish similarity of plane figures.

CC.2.3.HS.A.6 - Verify and apply theorems involving similarity as they relate to plane figures

Expectations for Students

- Translate a figure in the coordinate plane
- Reflect a figure in a line
- Rotate a figure about a point
- Dilate a figure to change the size but not the shape of a polygon
- Create the image that is congruent to a given triangle by performing congruence transformations
- Use scale factor of a dilation to reduce or enlarge a polygon
- Identify lines of symmetry
- Problem solve with real-world situations

The Standards for Mathematical Practice

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and make sense of regularity in repeated reasoning.

Activities and Experiences

Assessments
Calculators
Class Discussions
Computer Websites
Critical Thinking/Higher Level Questioning
Guided Practice
Homework
Manipulatives
Notes (Templates, Teacher or Student Generated)
Working in Small Groups
Review (Games, Study Guides)
Standardized Test Preparation
Teacher Demonstrations
Teacher Observations
Videos

Materials and Resources

Geometry, McGraw Hill, 2017
Internet resources
Calculators
Graphing Tools
Math notebook
Compasses
Rulers
Protractors
White boards

Assessments

Quizzes
Tests
Unit Tests
Homework
Terra Nova Test
Diagnostic Testing
Teacher Observation