North Gibson School Corporation

High School Geometry
SY 2022/2023

High School Geometry

Units of Study			
Unit 1:	Tools of Geometry	16 days	1st semester
Unit 2:	Angles and Geometric Figures	8 days	1st semester
Unit 3:	Logical Arguments and Line Relationships	15 days	1st semester
Unit 4:	Transformations and Symmetry	12 days	1st semester
Unit 5:	Triangles and Congruence	16 days	1st semester
Unit 6:	Relationships in Triangles	15 days	1st semester
Unit 7:	Quadrilaterals	13 days	2nd semester
Unit 8:	Similarity	13 days	2nd semester
Unit 9:	Right Triangles and Trigonometry	15 days	2nd semester
Unit 10:	Circles	17 days	2nd semester
Unit 11:	Measurement	16 days	2nd semester

Appendices

Appendix A: Proficiency Scale Template

Appendix B: Curriculum Refinement Form

Appendix C: North Gibson Priority Standards Vertical Articulation Document

High School Geometry Priority Standards

Priority Standards	**G.CI.4**	Solve real-world and other mathematical problems that involve finding measures of circumference, areas of circles and sectors, and arc lengths and related angles (central, inscribed, and intersections of secants and tangents).
	G.LP.2	Use precise definitions for angle, circle, perpendicular lines, parallel lines, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
	G.PL.1	Prove and apply theorems about lines and angles, including the following: -Vertical angles are congruent. -When a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent. -When a transversal crosses parallel lines, same side interior angles are supplementary. -Points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.
	G.PL.4	Develop the distance formula using the Pythagorean Theorem. Find the lengths and midpoints of line segments in the two-dimensional coordinate system.
	G.QP.1	Prove and apply theorems about parallelograms, including those involving angles, diagonals, and sides.
	G.QP.2	Prove that given quadrilaterals are parallelograms, rhombuses, rectangles, squares, kites, or trapezoids. Include coordinate proofs of quadrilaterals in the coordinate plane.
	G.T.1	Prove and apply theorems about triangles, including the following: -Measures of interior angles of a triangle sum to 180°. -The Isosceles Triangle Theorem and its converse. -The Pythagorean Theorem. -The segment joining midpoints of two sides of a triangle is parallel to the third side and half the length. -A line parallel to one side of a triangle divides the other two proportionally, and its converse. -The Angle Bisector Theorem.
	G.T.5	Use congruent and similar triangles to solve real-world and mathematical problems involving sides, perimeters, and areas of triangles.
	G.T.9	Use trigonometric ratios (sine, cosine, tangent and their inverses) and the Pythagorean Theorem to solve real-world and mathematical problems involving right triangles.
	G.TR.1	Use geometric descriptions of rigid motions to transform figures and to predict and describe the results of translations, reflections and rotations on a given figure. Describe a motion or series of motions that will show two shapes are congruent.
	G.TR.2	Verify experimentally the properties of dilations given by a center and a scale factor. Understand the dilation of a line segment is longer or shorter in the ratio given by the scale factor.
	G.TS.4	Solve real-world and other mathematical problems involving volume and surface area of prisms, cylinders, cones, spheres, and pyramids, including problems that involve composite solids and algebraic expressions.

Standards Breakdown

★: Priority Standards ●: Supporting Standards —: Additional Standards

STANDARDS		UNITS 1	2	3	4	5	6	7	8	9	10	11
Circles	1										●	
	2										●	●
	3										●	
	4										★	★
	5										—	
	6										—	
Logic and Proofs	1	●	●	●								
	2	★	★	★							★	
	3			●								
	4			—								
Points, Lines, Angles and Planes	1			★			★					
	2			●								
	3	—	—	—			—					
	4	★										
Quadrilaterals and Other Polygons	1							★				
	2							★				
	3							●				●
	4				●							
	5							●				
	6											●
Triangles	1					★	★		★	★		
	2					●						
	3					—						
	4								●			
	5					★			★			
	6						●					
	7									●		
	8									●		
	9									★		
	10									●		
Transformations	1				★	★						
	2								★			
Three-dimensional solids	1											●
	2											●
	3											●
	4											★
	5											—

Unit 1: Tools of Geometry (16 days, 1st semester)

General Description of the Unit

This unit serves as the foundation for the rest of the Geometry course. Notation, precise definitions, and the axiomatic systems are all introduced and will be embedded in the rest of the units. The distance formula is also introduced and used to find distance and midpoint on the coordinate plane. Finally, students will begin working with simple constructions to prepare them for more complex work in future units.

Priority Standards

- **G.LP.2:** Use precise definitions for angle, circle, perpendicular lines, parallel lines, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.
- **G.PL.4:** Develop the distance formula using the Pythagorean Theorem. Find the lengths and midpoints of line segments in the two-dimensional coordinate system.

Supporting Standards

- **G.LP.1:** Understand and describe the structure of and relationships within an axiomatic system (undefined terms, definitions, axioms and postulates, methods of reasoning, and theorems). Understand the differences among supporting evidence, counterexamples, and actual proofs.

Additional Standards

- **G.PL.3:** Use tools to explain and justify the process to construct congruent segments and angles, angle bisectors, perpendicular bisectors, altitudes, medians, and parallel and perpendicular lines.

Enduring Understandings

- The distance between two points on a coordinate plane can be found using the Pythagorean Theorem. This method can be generalized to develop the distance formula.
- It is important to be able to name and represent points, lines, and planes to communicate with and understand others. These terms are the foundation of geometry.
- A geometric construction can show the logic used to prove a specific theorem.

Essential Questions

- Why might a delivery company use the distance formula?
- When and why is it important to use precise terminology?

Key Concepts

- I can precisely define angle using words, diagrams, and notation. (G.LP.2)
- I can precisely define circle using words, diagrams, and notation. (G.LP.2)
- I can precisely define line segment using words, diagrams, and notation. (G.LP.2)
- I can precisely define parallel and perpendicular lines using words, diagrams, and notation. (G.LP.2)
- I can explain what the undefined terms are and why they are undefined. (G.LP.2)
- I can state the meaning of symbols and use them consistently and appropriately. (G.LP.2)
- I can develop the distance formula from what I know about the Pythagorean Theorem. (G.PL.4)
- I can find the midpoint of a line segment in the coordinate plane. (G.PL.4)
- I can find the lengths of line segments in the coordinate plane. (G.PL.4)

Related Concepts

- I can describe the structure of an axiomatic system and the relationships within. (G.LP.1)
- I can understand the difference among supporting evidence, counterexamples, and actual proofs. (G.LP.1)
- I can identify and name defined terms and undefined terms. (G.LP.1)
- I can apply definitions, postulates, and theorems to justify and support conclusions. (G.LP.1)
- I can select an appropriate tool when asked to explain and justify geometric constructions. (G.PL.3)
- I can explain and justify how to construct congruent segments. (G.PL.3)
- I can explain and justify how to construct congruent angles. (G.PL.3)
- I can explain and justify how to construct angle bisectors (G.PL.3)
- I can explain and justify how to construct perpendicular bisectors. (G.PL.3)

Vocabulary

- Altitude
- Angle
- Angle bisector
- Axiom
- Axiomatic system
- Circle
- Congruence
- Congruent angle
- Congruent segment
- Counterexample
- Distance formula
- Geometric notation
- Line
- Line Segment
- Median
- Midpoint
- Parallel Line
- Parallel lines
- Perpendicular bisector
- Perpendicular Line
- Perpendicular lines
- Plane
- Point
- Postulate
- Pythagorean Theorem
- Theorem

• I can find the midpoint and length of line segments given the endpoints of the segment. (G.PL.4)	• I can explain and justify how to construct altitudes and medians. (G.PL.3) • I can explain and justify how to construct parallel and perpendicular lines (G.PL.3)	• Undefined term

Mathematical Processes

- PS.5: Use appropriate tools strategically.
- PS.6: Attend precision.

Resources

Proficiency Scales	Digital	Manipulatives
• G.LP.2 • G.PL.4	• IDOE Examples/Tasks G.LP.2 • IDOE Examples/Tasks G.PL.4 • IDOE Examples/Tasks G.LP.1 • IDOE Examples/Tasks G.PL.3	• Compass • Desmos Geometry • Geogebra Angle Bisector Construction • Graph Paper • Protractor • Scientific Calculator • **Straightedge** • Virtual Graph Paper

School Resources

Textbook	Formative Assessments
Textbook: Indiana Reveal by McGraw-Hill Module 1: Tools of Geometry 1.1 The Geometric System: G.LP.1 1.2 Points, Lines, and Planes: G.LP.1, G.LP.2 1.3 Line Segments: G.LP.1, G.LP.2 1.4 Distance: G.PL.4 1.5 Locating Points on a Number Line (SKIP) 1.6 Locating Points on a Coordinate Plane: G.PL.4 1.7 Midpoints and Bisectors: G.PL.4, G.PL.3	

General Description of the Unit
In this unit, students continue to explore precise definitions and notation for geometric terms.

Priority Standards

- **G.LP.2:** Use precise definitions for angle, circle, perpendicular lines, parallel lines, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.

Supporting Standards

- **G.LP.1:** Understand and describe the structure of and relationships within an axiomatic system (undefined terms, definitions, axioms and postulates, methods of reasoning, and theorems). Understand the differences among supporting evidence, counterexamples, and actual proofs.

Additional Standards

- **G.PL.3:** Use tools to explain and justify the process to construct congruent segments and angles, angle bisectors, perpendicular bisectors, altitudes, medians, and parallel and perpendicular lines.

Enduring Understandings

- It is important to be able to name and represent points, lines, and planes to communicate with and understand others. These terms are the foundation of geometry.
- A geometric construction can show the logic used to prove a specific theorem.

Essential Questions

- When and why is it important to use precise terminology?
- What are real-life examples of angles?

Key Concepts

- I can precisely define angle using words, diagrams, and notation. (G.LP.2)
- I can precisely define circle using words, diagrams, and notation. (G.LP.2)
- I can precisely define line segment using words, diagrams, and notation. (G.LP.2)
- I can precisely define parallel and perpendicular lines using words, diagrams, and notation. (G.LP.2)
- I can explain what the undefined terms are and why they are undefined. (G.LP.2)
- I can state the meaning of symbols and use them consistently and appropriately. (G.LP.2)

Related Concepts

- I can describe the structure of an axiomatic system and the relationships within. (G.LP.1)
- I can understand the difference among supporting evidence, counterexamples, and actual proofs. (G.LP.1)
- I can identify and name defined terms and undefined terms. (G.LP.1)
- I can apply definitions, postulates, and theorems to justify and support conclusions. (G.LP.1)
- I can select an appropriate tool when asked to explain and justify geometric constructions. (G.PL.3)
- I can explain and justify how to construct congruent segments. (G.PL.3)
- I can explain and justify how to construct congruent angles. (G.PL.3)
- I can explain and justify how to construct angle bisectors (G.PL.3)
- I can explain and justify how to construct perpendicular bisectors. (G.PL.3)
- I can explain and justify how to construct altitudes and medians. (G.PL.3)
- I can explain and justify how to construct parallel and perpendicular lines (G.PL.3)

Vocabulary

- Altitude
- Angle
- Angle bisector
- Axiom
- Axiomatic system
- Circle
- Congruence
- Congruent angle
- Congruent segment
- Counterexample
- Geometric notation
- Line
- Line Segment
- Median
- Parallel Line
- Parallel lines
- Perpendicular bisector
- Perpendicular Line
- Perpendicular lines
- Plane
- Point
- Postulate
- Theorem
- Undefined term

Mathematical Processes

- PS.5: Use appropriate tools strategically.
- PS.6: Attend precision.

Resources

Proficiency Scales	Digital	Manipulatives
• G.LP.2	• IDOE Examples/Tasks G.LP.2 • IDOE Examples/Tasks G.LP.1 • IDOE Examples/Tasks G.PL.3	• Compass • Desmos Geometry • Geogebra Angle Bisector Construction • Protractor • **Straightedge**

School Resources

Textbook	Formative Assessments
Module 2: Angles and Geometric Figures 2.1 Angles and Congruence: G.LP.1, G.LP.2, G.PL.3 2.2 Angle Relationships: G.LP.1, G.LP.2, G.PL.3 2.3 Two-Dimensional Figures: (Optional Review) 2.4 Transformations in the Plane: (SKIP) 2.5 Three-Dimensional Figures (SKIP) 2.6 Two-Dimensional Representations of Three-Dimensional Figures (SKIP) 2.7 Precision and Accuracy (SKIP) 2.8 Representing Measurements (SKIP)	

General Description of the Unit

Now students will begin to work with proofs, which includes exploring conditional statements, looking at the different types of proofs, and writing simple proofs (such as algebraic proofs). Students will continue this skill into future units, where they will write more complex geometric proofs. Additionally, students will explore lines and angles, both on and off of the coordinate system. They will discover the relationship between vertical angles and angles formed by a transversal through parallel lines; they will use these angles relationships to solve problems, including those involving setting up algebraic equations to solve for a variable.

Note that sections 3.3, 3.4, 3.5, and 3.6 are taught but only with light coverage. In section 3.1, give special attention to patterns for SAT preparation.

Priority Standards

- **G.PL.1:** Prove and apply theorems about lines and angles, including the following:
  -Vertical angles are congruent.
  -When a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent.
  -When a transversal crosses parallel lines, same side interior angles are supplementary.
  -Points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.
- **G.LP.2:** Use precise definitions for angle, circle, perpendicular lines, parallel lines, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.

Supporting Standards

- **G.LP.3:** State, use, and examine the validity of the converse, inverse, and contrapositive of conditional ("if – then") and bi-conditional ("if and only if") statements.
- **G.PL.2:** Explore the relationships of the slopes of parallel and perpendicular lines. Determine if a pair of lines are parallel, perpendicular, or neither by comparing the slopes in coordinate graphs and equations.
- **G.LP.1:** Understand and describe the structure of and relationships within an axiomatic system (undefined terms, definitions, axioms and postulates, methods of reasoning, and theorems). Understand the differences among supporting evidence, counterexamples, and actual proofs.

Additional Standards

- **G.LP.4:** Understand that proof is the means used to demonstrate whether a statement is true or false mathematically. Develop geometric proofs, including those involving coordinate geometry, using two-column, paragraph, and flow chart formats.
- **G.PL.3:** Use tools to explain and justify the process to construct congruent segments and angles, angle bisectors, perpendicular bisectors, altitudes, medians, and parallel and perpendicular lines.

Enduring Understandings

- Many angle pairs (vertical, those cut by a transversal across parallel lines) have consistent relationships, such as congruent or supplementary.
- Being able to carefully examine the validity of real-world conditional statements prepares us to do the same with geometric statements.
- Practicing geometric proofs strengthens deductive reasoning skills and heightens understanding of given theorems and postulates.

Essential Questions

- Why might an architect use the angle relationships formed by a transversal crossing parallel lines?
- How do properties of parallel and perpendicular lines help us understand the world around us?
- Why do we prove statements that have already been previously proven?

Key Concepts

- I can precisely define angle using words, diagrams, and notation. (G.LP.2)
- I can precisely define circle using words, diagrams, and notation. (G.LP.2)
- I can precisely define line segment using words, diagrams, and notation. (G.LP.2)

Related Concepts

- I can describe the structure of an axiomatic system and the relationships within. (G.LP.1)
- I can understand the difference among supporting evidence, counterexamples, and actual proofs. (G.LP.1)

Vocabulary

- Alternate Exterior Angles Theorem
- Alternate Interior Angles Theorem
- Altitude
- Angle
- Angle bisector
- Axiom
- Axiomatic system
- Biconditional statement

- I can precisely define parallel and perpendicular lines using words, diagrams, and notation. (G.LP.2)
- I can explain what the undefined terms are and why they are undefined. (G.LP.2)
- I can state the meaning of symbols and use them consistently and appropriately. (G.LP.2)
- I can prove that vertical angles are congruent and apply that fact to problems. (G.PL.1)
- I can prove and apply the angle relationships formed when two parallel lines are cut by a transversal. (G.PL.1)

- I can identify and name defined terms and undefined terms. (G.LP.1)
- I can apply definitions, postulates, and theorems to justify and support conclusions. (G.LP.1)
- I can write the converse, inverse, and contrapositive of conditional and biconditional statements. (G.LP.3)
- I can apply the converse, inverse, and contrapositive of conditional and biconditional statements. (G.LP.3)
- I can determine the validity of converse, inverse, and contrapositive statements. (G.LP.3)
- I can graph parallel lines and discover that their slopes are the same. (G.PL.2)
- I can graph perpendicular lines and discover their slopes are opposite reciprocals. (G.PL.2)
- I can justify why perpendicular lines may have the same y-intercept while parallel lines may not. (G.PL.2)
- I can determine whether two lines are parallel, perpendicular, or neither given the equation. (G.PL.2)
- I can determine whether two lines are parallel, perpendicular, or neither given the graph. (G.PL.2)
- I can explain the rationale for using proof in mathematics. (G.LP.4)
- I can use coordinate geometry to develop geometric proofs . (G.LP.4)
- I can develop geometric proofs in a two column format. (G.LP.4)
- I can develop geometric proofs in a paragraph format. (G.LP.4)
- I can develop geometric proofs in a flow chart format. (G.LP.4)
- I can connect related two-column proofs, paragraph proofs, and flow proofs. (G.LP.4)
- I can select an appropriate tool when asked to explain and justify geometric constructions. (G.PL.3)
- I can explain and justify how to construct congruent segments. (G.PL.3)
- I can explain and justify how to construct congruent angles. (G.PL.3)
- I can explain and justify how to construct angle bisectors (G.PL.3)

- Circle
- Conditional statement
- Congruence
- Congruent angle
- Congruent segment
- Contrapositive
- Converse
- Coordinate proof
- Corresponding Angles Postulate
- Counterexample
- Direct proof
- Flow chart proof
- Geometric notation
- Geometric proof
- Inverse
- Line
- Line Segment
- Median
- Opposite
- Paragraph proof
- Parallel Line
- Parallel lines
- Perpendicular bisector
- Perpendicular Line
- Perpendicular lines
- Plane
- Point
- Postulate
- Reciprocal
- Same Side Interior Angles Theorem
- Slope
- Slope-intercept form
- Theorem
- Transversal
- Two-column proof
- Undefined term
- Vertical Angle Congruence Theorem

	• I can explain and justify how to construct perpendicular bisectors. (G.PL.3) • I can explain and justify how to construct altitudes and medians. (G.PL.3) • I can explain and justify how to construct parallel and perpendicular lines (G.PL.3)	

Mathematical Processes

- PS.3: Construct convincing arguments and critique the reasoning of others.
- PS.6: Attend precision.

Resources

Proficiency Scales	Digital	Manipulatives
• G.LP.2 • G.PL.1	• IDOE Examples/Tasks G.LP.2 • IDOE Examples/Tasks G.PL.1 • IDOE Examples/Tasks G.LP.1 • IDOE Examples/Tasks G.LP.3 • IDOE Examples/Tasks G.PL.2 • IDOE Examples/Tasks G.LP.4 • IDOE Examples/Tasks G.PL.3	• Compass • Coordinate Grid • Desmos Geometry • Geogebra Angle Bisector Construction • Graphing Calculator • Protractor • Prove It! Two Column Proof Practice • Prove It! Two Column Proof Practice • Scientific Calculator • **Straightedge**

School Resources

Textbook	Formative Assessments
Module 3: Logical Arguments and Line Relationships 3.1 Conjectures and Counterexamples: G.LP.1, G.LP.2, G.LP.3, 3.2 Statements, Conditionals, and Biconditionals: G.LP.1, G.LP.2, G.LP.3 3.3 Deductive Reasoning: G.LP.1, G.LP.2, G.LP.3 (Light) 3.4 Writing Proofs: G.LP.1, G.LP.2, G.LP.4 (Light) 3.5 Proving Segment Relationships: G.LP.4, G.PL.3 (Light) 3.6 Proving Angle Relationships: G.LP.4, G.PL.1, G.PL.3 (Light) 3.7 Parallel Lines and Transversals: G.LP.4, G.PL.1 3.8 Slope and Equations of Lines: G.PL.2 3.9 Proving Lines Parallel: G.LP.4, G.PL.1, G.PL.3 (SKIP) 3.10 Perpendiculars and Distance: G.PL.1, G.PL.2, G.PL.3 (SKIP)	

General Description of the Unit

In this unit, students work with rigid transformations, a topic they explored in 8th grade. They will use transformations to establish triangle congruence in the next unit. Polygons of symmetry is also taught.

Priority Standards

- **G.TR.1:** Use geometric descriptions of rigid motions to transform figures and to predict and describe the results of translations, reflections and rotations on a given figure. Describe a motion or series of motions that will show two shapes are congruent.

Supporting Standards

- **G.QP.4:** Identify types of symmetry of polygons, including line, point, rotational, and self-congruences.

Enduring Understandings

- A rigid transformation only changes the location of a figure, so the original figure and the image are congruent.
- Translation shifts a point (or points) horizontally and vertically. Rotation turns a point (or points) around a fixed center point. Reflection mirrors a point (or points) over a given line.
- Two objects can be proven congruent using rigid transformations.

Essential Questions

- What is an example of a rigid transformation in the real-world?
- How does polygon symmetry relate to transformations?

Key Concepts

- I can show two figures are congruent if there is a sequence of rigid motions that map one figure to another. (G.TR.1)
- I can show two figures are congruent if and only if they have the same shape and size. (G.TR.1)
- I can use composite transformations to map one figure to another. (G.TR.1)
- I can recognize the effects of rigid motion on orientation and location of a figure. (G.TR.1)

Related Concepts

- I can identify line, point, and/or rotational symmetry in a variety of polygons. (G.QP.4)
- I can identify self-congruence in polygons. (G.QP.4)

Vocabulary

- Congruent
- Line symmetry
- Point symmetry
- Reflections
- Rigid Motion
- Rotational symmetry
- Rotations
- Self-congruency
- Symmetry
- Transformations
- Translations

Mathematical Processes

- PS.2: Reason abstractly and quantitatively.
- PS.3 Construct convincing arguments and critique the reasoning of others.

Resources

Proficiency Scales

- G.TR.1

Digital

- IDOE Examples/Tasks G.TR.1
- IDOE Examples/Tasks G.QP.4

Manipulatives

- Compass
- Desmos Geometry
- Graph Paper
- Protractor
- Scientific Calculator
- **Straightedge**
- Virtual Graph Paper

School Resources	
Textbook Module 4: Transformations and Symmetry 4.1 Reflections: G.TR.1 4.2 Translations: G.TR.1 4.3 Rotations: G.TR.1 4.4 Compositions of Transformations: G.TR.1 4.5 Tessellations (SKIP) 4.6 Symmetry: G.QP.4 (Light)	**Formative Assessments**

General Description of the Unit

In this unit, students will solve real-world and mathematical problems involving congruent triangles. To achieve this goal, students will explore congruency from transformations, and then build on this understanding to learn and apply the triangle congruence theorems (ASA, SAS, AAS, SSS, HL). Additionally, students will construct congruent triangles, segments, and angles. This is a good unit to work on proofs by having students prove triangle congruency.

Priority Standards

- **G.T.1:** Prove and apply theorems about triangles, including the following:
  -Measures of interior angles of a triangle sum to 180°.
  -The Isosceles Triangle Theorem and its converse.
  -The Pythagorean Theorem.
  -The segment joining midpoints of two sides of a triangle is parallel to the third side and half the length.
  -A line parallel to one side of a triangle divides the other two proportionally, and its converse.
  -The Angle Bisector Theorem.
- **G.T.5:** Use **congruent** and similar triangles to solve real-world and mathematical problems involving sides, perimeters, and areas of triangles.
- **G.TR.1:** Use geometric descriptions of rigid motions to transform figures and to predict and describe the results of translations, reflections and rotations on a given figure. Describe a motion or series of motions that will show two shapes are congruent.

Supporting Standards

- **G.T.2:** Explore and explain how the criteria for triangle congruence (ASA, SAS, AAS, SSS, and HL) follow from the definition of congruence in terms of rigid motions.

Additional Standards

- **G.T.3:** Use tools to explain and justify the process to construct congruent triangles.

Enduring Understandings

- Practicing geometric proofs strengthens deductive reasoning skills and heightens understanding of given theorems and postulates.
- Facts about congruent triangles are additional tools that can be used when analyzing a situation involving triangles.
- Two objects can be proven congruent using rigid transformations.
- There are 5 main theorems for proving triangle congruence. Other triangle theorems may be needed as accessories in the proof.

Essential Questions

- What key features in a diagram can help select a theorem to apply to a problem?
- What is an example of a rigid transformation in the real-world?
- How do I decide which theorem to use when proving two triangles are congruent?
- What are some real-world settings that might need to construct congruent triangles?

Key Concepts

- I can prove and apply that the sum of the interior angles of a triangle is 180°. (G.T.1)
- I can prove and apply the Isosceles Triangle Theorem. (G.T.1)
- I can prove and apply the converse of the Isosceles Triangle Theorem. (G.T.1)
- I can solve real-world problems using congruent triangles, including perimeter, area, and missing lengths. (G.T.5)
- I can solve problems using CPCTC (corresponding part of congruent triangles are congruent). (G.T.5)
- I can show two figures are congruent if there is a sequence of

Related Concepts

- I can identify corresponding angles and sides based on congruence statements. (G.T.2)
- I can write congruence statements for two congruent triangles. (G.T.2)
- I can determine if two triangles are congruent based on their corresponding parts. (G.T.2)
- I can explain and apply the criteria of SSS, SAS, AAS, HL and ASA to prove triangle congruence. (G.T.2)
- I can explain when it is appropriate to use HL. (G.T.2)
- I can show cases in which AA and SSA do and do not prove triangle congruence. (G.T.2)

Vocabulary

- Angle-Angle
- Angle-Angle-Side triangle congruence
- Angle-Side-Angle triangle congruence
- Area of a triangle
- Base Angles Theorem
- Congruence
- Congruent
- Congruent triangles
- CPCTC
- Hypotenuse-Leg triangle congruence
- Isosceles Triangle Theorem
- Midsegment Theorem
- Perimeter

rigid motions that map one figure to another. (G.TR.1) • I can show two figures are congruent if and only if they have the same shape and size. (G.TR.1) • I can use composite transformations to map one figure to another. (G.TR.1) • I can recognize the effects of rigid motion on orientation and location of a figure. (G.TR.1)	• I can explain the connection between the criteria for triangle congruence and rigid motions. (G.T.2) • I can select an appropriate tool when asked to explain and justify geometric constructions. (G.T.3) • I can construct congruent triangles with a variety of geometric tools. (G.T.3) • I can explain and justify the process of my construction. (G.T.3)	• Pythagorean Theorem • Reflections • Rigid Motion • Rotations • Side-Angle-Side triangle congruence • Side-Side-Angle • Side-Side-Side triangle congruence • Similar triangles • Transformations • Translations • Triangle Sum Theorem

Mathematical Processes

- PS.3 Construct convincing arguments and critique the reasoning of others.
- PS.7: Look for and make use of structure.

Resources

Proficiency Scales	Digital	Manipulatives
• G.T.1 • G.T.5 • G.TR.1	• IDOE Examples/Tasks G.T.1 • IDOE Examples/Tasks G.T.5 • IDOE Examples/Tasks G.TR.1 • IDOE Examples/Tasks G.T.2 • IDOE Examples/Tasks G.T.3	• Compass • Desmos Geometry • Graph Paper • Graphing Calculator • Protractor • Prove It! Two Column Proof Practice • Scientific Calculator • **Straightedge** • Straws (Congruence Discovery)

School Resources

Textbook	Formative Assessments
Module 5: Triangles and congruence 5.1 Angles of triangles: G.T.1 5.2 Congruent triangles: G.T.3, G.TR.1 5.3 Proving triangles congruent: SSS, SAS: G.T.2, G.T.3, G.T.5 5.4 Proving triangles congruent: ASA, AAS: G.T.2, G.T.3, G.T.5 5.5 Proving right triangles congruent: G.T.2, G.T.3 5.6 Isosceles and equilateral triangles: G.T.1 5.7 Triangles and coordinate proofs: (SKIP)	

General Description of the Unit

In this unit, students will prove and apply a variety of triangle theorems. Proof is an integral part of this unit, and constructions are also be included. Many previous theorems and facts will be spiraled into this unit to aid in solving problems involving triangles.

Priority Standards

- **G.PL.1:** Prove and apply theorems about lines and angles, including the following:
  -Vertical angles are congruent.
  -When a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent.
  -When a transversal crosses parallel lines, same side interior angles are supplementary.
  -Points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.
- **G.T.1:** Prove and apply theorems about triangles, including the following:
  -Measures of interior angles of a triangle sum to 180°.
  -The Isosceles Triangle Theorem and its converse.
  -The Pythagorean Theorem.
  -The segment joining midpoints of two sides of a triangle is parallel to the third side and half the length.
  -A line parallel to one side of a triangle divides the other two proportionally, and its converse.
  -The Angle Bisector Theorem.

Supporting Standards

- **G.T.6:** Prove and apply the inequality theorems, including the following:
  -Triangle inequality.
  -Inequality in one triangle.
  -The hinge theorem and its converse.

Additional Standards

- **G.PL.3:** Use tools to explain and justify the process to construct congruent segments and angles, angle bisectors, perpendicular bisectors, altitudes, medians, and parallel and perpendicular lines.

Enduring Understandings

- Knowing multiple theorems about triangles gives us a set of tools to use when analyzing a specific triangle.
- The relationships that exist between segments and angles in triangles can be proven.

Essential Questions

- What processes help me stay organized and focused when proving theorems about triangles?
- How does a midsegment relate to the sides of a triangle?
- What triangle theorem (or theorems) do you think is most often utilized when working with triangles?

Key Concepts

- I can prove that vertical angles are congruent and apply that fact to problems. (G.PL.1)
- I can prove and apply the angle relationships formed when two parallel lines are cut by a transversal. (G.PL.1)
- I can prove that all points on the perpendicular bisector of a segment are equidistant from the segment endpoints and apply that fact to problems. (G.PL.1)
- I can prove and apply that the sum of the interior angles of a triangle is 180°. (G.T.1)
- I can prove and apply the Isosceles Triangle Theorem. (G.T.1)
- I can prove and apply the converse of the Isosceles Triangle Theorem. (G.T.1)

Related Concepts

- I can prove and apply the triangle inequality theorem. (G.T.6)
- I can prove and apply the greater angle and greater side theorem. (G.T.6)
- I can prove and apply the Hinge Theorem and its converse. (G.T.6)
- I can select an appropriate tool when asked to explain and justify geometric constructions. (G.PL.3)
- I can explain and justify how to construct congruent segments. (G.PL.3)
- I can explain and justify how to construct congruent angles. (G.PL.3)
- I can explain and justify how to construct angle bisectors (G.PL.3)

Vocabulary

- Alternate Exterior Angles Theorem
- Alternate Interior Angles Theorem
- Altitude
- Angle bisector
- Base Angles Theorem
- Congruence
- Congruent angle
- Congruent segment
- Corresponding Angles Postulate
- Hinge Theorem
- Inequality in One Triangle Theorem
- Median
- Midsegment Theorem
- Parallel lines
- Perpendicular bisector
- Perpendicular Bisector Theorem
- Perpendicular lines
- Same Side Interior Angles Theorem

• I can prove and apply that the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length. (G.T.1) • I can prove the Pythagorean Theorem. (G.T.1)	• I can explain and justify how to construct perpendicular bisectors. (G.PL.3) • I can explain and justify how to construct altitudes and medians. (G.PL.3) • I can explain and justify how to construct parallel and perpendicular lines (G.PL.3)	• Transversal • Triangle Inequality Theorem • Triangle Sum Theorem • Vertical Angle Congruence Theorem

Mathematical Processes

- PS.1: Make sense of problems and persevere in solving them.
- PS.3 Construct convincing arguments and critique the reasoning of others.

Resources

Proficiency Scales	Digital	Manipulatives
• G.PL.1 • G.T.1	• IDOE Examples/Tasks G.PL.1 • IDOE Examples/Tasks G.T.1 • IDOE Examples/Tasks G.T.6 • IDOE Examples/Tasks G.PL.3	• Compass • Desmos Geometry • Geogebra Angle Bisector Construction • Graph Paper • Graphing Calculator • Protractor • Prove It! Two Column Proof Practice • Scientific Calculator • **Straightedge**

School Resources

Textbook	Formative Assessments
Module 6: Relationships in Triangles 6.1 Perpendicular Bisectors: G.LP.4, G.PL.1, G.PL.3, G.T.1 6.2 Angle Bisectors: G.LP.4, G.PL.3, G.T.1 6.3 Medians and Altitudes of Triangles: G.PL.3, G.T.1 6.4 Inequalities in One Triangle: G.T.6 6.5 Indirect Proof: (SKIP) 6.6 The Triangle Inequality Theorem: G.T.6 6.7 Inequalities in Two Triangles: G.T.6 (Only Hinge Thm)	

General Description of the Unit

In this unit, strict definitions are used to classify a quadrilateral; this includes writing a proof to justify the classification, both on and off the coordinate plane. Parallelograms are studied the most in depth, with multiple theorems about parallelograms being proven and applied.

Priority Standards

- **G.QP.1:** Prove and apply theorems about parallelograms, including those involving angles, diagonals, and sides.
- **G.QP.2:** Prove that given quadrilaterals are parallelograms, rhombuses, rectangles, squares, kites, or trapezoids. Include coordinate proofs of quadrilaterals in the coordinate plane.

Supporting Standards

- **G.QP.3:** Develop and use formulas to find measures of interior and exterior angles of polygons.
- **G.QP.5:** Compute perimeters and areas of polygons in the coordinate plane to solve real-world and other mathematical problems.

Enduring Understandings

- Because parallelograms are formed by two sets of parallel lines, we can prove many theorems about the relationships between angles, sides, and diagonals.
- Quadrilaterals are classified using specific relationships among the side lengths and angle measures. These properties can be verified using slope, the distance formula, and the Pythagorean Theorem, among other things.
- The sum of the interior angles of a polygon is a function of the number of sides; the sum of the exterior angles of a polygon is always 360.
- The distance formula can be applied to find the area or perimeter of a shape on the coordinate plane.

Essential Questions

- What is a real-world situation where the properties of a parallelogram would be helpful to know?
- What are the benefits of plotting a shape on the coordinate plane?
- Why does the sum of the interior angles of a polygon depend on the number of sides, yet the exterior angle sum remains constant?
- What are the benefits of plotting a shape on the coordinate plane?

Key Concepts

- I can prove properties of parallelograms then apply them. (G.QP.1)
- I can prove that opposite sides are congruent in parallelograms and apply my understanding. (G.QP.1)
- I can prove that opposite angles are congruent in parallelograms and apply my understanding. (G.QP.1)
- I can prove that the diagonals of a parallelogram bisect each other and apply my understanding. (G.QP.1)
- I can prove rectangles are parallelograms with congruent diagonals. (G.QP.1)
- I can prove properties of rectangles. (G.QP.2)
- I can prove the properties of rhombi. (G.QP.2)
- I can prove the properties of squares. (G.QP.2)
- I can prove the properties of kites. (G.QP.2)
- I can classify a quadrilateral by its properties. (G.QP.2)
- I can classify a quadrilateral through the use of coordinate proof. (G.QP.2)

Related Concepts

- I can conclude that the measures of the exterior angles of any polygon sum to 360° through exploration. (G.QP.3)
- I can develop a strategy for finding the measure of a single exterior angle of a regular polygon. (G.QP.3)
- I can find patterns and develop the formula for the sum of the measures of the interior angles of a polygon. (G.QP.3)
- I can find the measure of a single angle in a regular polygon given the sum of the interior angles. (G.QP.3)
- I can find the measures of sides of a polygon on the coordinate plane. (G.QP.5)
- I can use the distance formula or Pythagorean theorem to compute the perimeter and/or area of polygons in the coordinate plane. (G.QP.5)
- I can solve real-world problems involving perimeter and area of polygons in the coordinate plane. (G.QP.5)

Vocabulary

- Area
- Bisect
- Coordinate plane
- Coordinate proof
- Diagonal
- Distance formula
- Exterior angle
- Interior angle
- Parallelogram
- Perimeter
- Polygon
- Pythagorean Theorem
- Quadrilaterals
- Rectangle
- Regular polygon
- Rhombus
- Square
- Theorems about parallelograms
- Trapezoid

Mathematical Processes

- PS.2: Reason abstractly and quantitatively.
- PS.8: Look for and express regularity with repeated reasoning.

Resources

Proficiency Scales	Digital	Manipulatives
• G.QP.1 • G.QP.2	• IDOE Examples/Tasks G.QP.1 • IDOE Examples/Tasks G.QP.2 • IDOE Examples/Tasks G.QP.3 • IDOE Examples/Tasks G.QP.5	• Graph Paper • Scientific Calculator • Virtual Graph Paper

School Resources

Textbook	Formative Assessments
Module 7: Quadrilaterals 7.1 Angles of Polygons: G.QP.3 7.2 Parallelograms: G.QP.1, G.QP.2 7.3 Tests for Parallelograms: G.QP.1, G.QP.2 7.4 Rectangles: G.QP.1, G.QP.2, G.QP.5 7.5 Rhombi and Squares: G.QP.1, G.QP.2, G.QP.5 7.6 Trapezoids and Kites: G.QP.1, G.QP.2	

General Description of the Unit

The end goal of this unit is to apply triangle similarity theorems to real-world and mathematical problems. To get here, students first work with dilations in depth, and then use dilations and other transformations to explore similarity. Then students will apply the definition of similarity to solve problems. It is important to note that the concept of similarity is the foundation for the next unit, Right Triangles and Trigonometry.

Priority Standards

- **G.T.5:** Use congruent and **similar** triangles to solve real-world and mathematical problems involving sides, perimeters, and areas of triangles.
- **G.TR.2:** Verify experimentally the properties of dilations given by a center and a scale factor. Understand the dilation of a line segment is longer or shorter in the ratio given by the scale factor.
- **G.T.1:** Prove and apply theorems about triangles, including the following:
  -Measures of interior angles of a triangle sum to 180°.
  -The Isosceles Triangle Theorem and its converse.
  -The Pythagorean Theorem.
  -The segment joining midpoints of two sides of a triangle is parallel to the third side and half the length.
  -A line parallel to one side of a triangle divides the other two proportionally, and its converse.
  -The Angle Bisector Theorem.

Supporting Standards

- **G.T.4:** Use the definition of similarity in terms of similarity transformations, to determine if two given triangles are similar. Explore and develop the meaning of similarity for triangles.

Enduring Understandings

- A rigid transformation only changes the location of a figure, so the original figure and the image are congruent. A non-rigid transformation (dilation) changes the size of a figure proportionally, so the original figure and the image are similar.
- Non-rigid transformations occur any time a figure's size is altered but remains proportional to its original shape.
- Proportionality can be used to solve for missing pieces in similar triangles.

Essential Questions

- How are the properties of similar triangles and congruent triangles different? How are they alike?
- How do non-rigid transformations occur in real-world problems?

Key Concepts

- I can solve real-world problems involving similar triangles, including perimeter, area, and missing lengths. (G.T.5)
- I can develop the properties of dilations given by a center and scale factor. (G.TR.2)
- I can perform dilations when the center of dilation is in, on, and out of a figure. (G.TR.2)
- I can dilate a figure when given the center of dilation and a scale factor. (G.TR.2)
- I can determine the center of dilation and the scale factor from a diagram. (G.TR.2)

Related Concepts

- I can identify corresponding angles and sides based on similarity statements. (G.T.4)
- I can develop and write similarity statements for two triangles. (G.T.4)
- I can determine if two triangles are similar based on their corresponding parts. (G.T.4)
- I can prove two triangles to be similar using the minimum requirements of AA. (G.T.4)

Vocabulary

- Angle-Angle triangle similarity
- Area of a triangle
- Base Angles Theorem
- Corresponding parts
- CPCTC
- Dilation
- Perimeter
- Proportional
- Pythagorean Theorem
- Scale factor
- Similar triangles
- Similarity
- Similarity transformation
- Triangle Proportionality Theorem
-

Mathematical Processes

- PS.3 Construct convincing arguments and critique the reasoning of others.
- PS.4 Model with mathematics.

Resources		
Proficiency Scales • G.T.1 • G.T.5 • G.TR.2 – Blank Template	**Digital** • IDOE Examples/Tasks G.T.1 • IDOE Examples/Tasks G.T.5 • IDOE Examples/Tasks G.TR.2 • IDOE Examples/Tasks G.T.4	**Manipulatives** • Compass • Desmos Geometry • Graph Paper • Graphing Calculator • Protractor • Prove It! Two Column Proof Practice • Scientific Calculator • **Straightedge**

School Resources	
Textbook Module 8: Similarity 8.1 Dilations: G.TR.2 8.2 Similar Polygons: G.T.4 8.3 Similar Triangles: AA Similarity: G.T.4, G.T.5, G.T.7, G.LP.4 8.4 Similar Triangles: SSS and SAS Similarity: G.T.4, G.T.5 (Light) 8.5 Triangle Proportionality: G.T.1, G.T.5 8.6 Parts of Similar Triangles: G.T.4, G.T.5	**Formative Assessments**

General Description of the Unit

This unit extends the concept of similarity to introduce the trigonometric ratios. Students will explore and apply special right triangles and the six trigonometric ratios to solve both real-world and mathematical problems. The Pythagorean Theorem is also readily used in these problems.

Priority Standards

- **G.T.9:** Use trigonometric ratios (sine, cosine, tangent and their inverses) and the Pythagorean Theorem to solve real-world and mathematical problems involving right triangles.
- **G.T.1:** Prove and apply theorems about triangles, including the following:
  -Measures of interior angles of a triangle sum to 180°.
  -The Isosceles Triangle Theorem and its converse.
  -The Pythagorean Theorem.
  -The segment joining midpoints of two sides of a triangle is parallel to the third side and half the length.
  -A line parallel to one side of a triangle divides the other two proportionally, and its converse.
  -The Angle Bisector Theorem.

Supporting Standards

- **G.T.10:** Explore the relationship between the sides of special right triangles (30° - 60° and 45° - 45°) and use them to solve real-world and other mathematical problems.
- **G.T.7:** Explore the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle. Understand and use the geometric mean to solve for missing parts of triangles.
- **G.T.8:** 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.

Enduring Understandings

- The missing sides and angles of a triangle can be solved for using the trigonometric ratios, the inverses of the trigonometric ratios, and the Pythagorean Theorem.
- There are many theorems that can be used to solve for missing pieces in a triangle; sometimes additional segments (such as an altitude) need to be added to a triangle to apply a formula.
- The ratio of corresponding sides in a pair of similar triangles will always be the same. This leads to the trigonometric ratios.

Essential Questions

- How can trigonometry be applied to real world situations?
- What are some reasons that could explain why 45-45-90 and 30-60-90 triangles were identified as being the special right triangles?
- What key features in a diagram can help select a theorem to apply to a problem?
- How does similarity relate to trigonometric ratios?

Key Concepts

- I can prove the Pythagorean Theorem. (G.T.1)
- I can determine the most appropriate trigonometric ratio (sine, cosine, tangent) to use for a given problem based on the information provided. (G.T.9)
- I can solve for sides and angles of right triangles using trigonometry. (G.T.9)
- I can interpret verbal descriptions into lengths and angles of a right triangle to diagram a relationship. (G.T.9)
- I can identify whether the Pythagorean Theorem or trigonometry is necessary to solve a problem involving missing lengths of right triangles. (G.T.9)

Related Concepts

- I can collect data to identify patterns when exploring the relationships between sides of 45°-45°-90° triangles. (G.T.10)
- I can collect data to identify patterns when exploring the relationships between sides of 30°-60°-90° triangles. (G.T.10)
- I can use special right triangles to solve mathematical problems. (G.T.10)
- I can use special right triangles to solve real-world problems. (G.T.10)
- I can explore the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle. (G.T.7)
- I can define the geometric mean as a way of finding a value between widely different values. (G.T.7)
- I can find the geometric mean between two numbers. (G.T.7)
- I can use the geometric mean to solve for sides of triangles. (G.T.7)

Vocabulary

- 30°-60°-90° triangle
- 45°-45°-90° triangle
- Acute angles
- Altitude
- Arithmetic mean
- Base Angles Theorem
- Cosine
- Geometric mean
- Hypotenuse
- Pythagorean Theorem
- Ratio
- Reference angle
- Right triangle
- Similarity
- Sine
- Special right triangles
- Square root
- Tangent
- Trigonometric ratios

	• I can label a triangle in relation to the reference angle (opposite, adjacent, hypotenuse). (G.T.8) • I can write the basic trigonometric ratios given three side lengths, or given two side lengths. (G.T.8) • I can collect data to identify patterns when forming ratios that lead to the definition of the Trigonometric ratios. (G.T.8)	

Mathematical Processes

- PS.3 Construct convincing arguments and critique the reasoning of others.
- PS.7: Look for and make use of structure.

Resources

Proficiency Scales	Digital	Manipulatives
• G.T.1 • G.T.9	• IDOE Examples/Tasks G.T.1 • IDOE Examples/Tasks G.T.9 • IDOE Examples/Tasks G.T.10 • IDOE Examples/Tasks G.T.7 • IDOE Examples/Tasks G.T.8	• Compass • Desmos Geometry • Graph Paper • Graphing Calculator • Isosceles Right Triangle: Quick Investigation • Protractor • Prove It! Two Column Proof Practice • Scientific Calculator • **Straightedge**

School Resources

Textbook	Formative Assessments
Module 9: Right Triangles and Trigonometry 9.1 Geometric Mean: G.T.7 9.2 Pythagorean Theorem and Its Converse: G.T.1, G.T.9 9.3 Coordinates in Space (SKIP) 9.4 Special Right Triangles: G.T.10 9.5 Trigonometry: G.T.8 9.6 Applying Trigonometry: G.T.8, G.T.9 9.7 The Law of Sines (SKIP) 9.8 The Law of Cosines (SKIP)	

General Description of the Unit

This unit focuses on properties of circles. There are a variety of relationships that students will explore and apply, including angles formed from segments (chords, secants, and tangents) on the circle, sectors, arc length, and tangent lines. Students will write formal proofs about a quadrilateral inscribed in a circle. Additionally, students will perform several constructions involving circles, tangent lines, and inscribed/circumscribed circles of a triangle.

Priority Standards

- **G.CI.4:** Solve real-world and other mathematical problems that involve finding measures of circumference, areas of circles and sectors, and arc lengths and related angles (central, inscribed, and intersections of secants and tangents).
- **G.LP.2:** Use precise definitions for angle, **circle**, perpendicular lines, parallel lines, and line segment, based on the undefined notions of point, line, and plane. Use standard geometric notation.

Supporting Standards

- **G.CI.1:** Define, identify and use relationships among the following: radius, diameter, arc, measure of an arc, chord, secant, tangent, congruent circles, and concentric circles.
- **G.CI.2:** Derive the fact that the length of the arc intercepted by an angle is proportional to the radius; derive the formula for the area of a sector.
- **G.CI.3:** Explore and use relationships among inscribed angles, radii, and chords, including the following:
  -The relationship that exists between central, inscribed, and circumscribed angles.
  -Inscribed angles on a diameter are right angles.
  -The radius of a circle is perpendicular to a tangent where the radius intersects the circle.

Additional Standards

- **G.CI.5:** Use tools to explain and justify the process to construct a circle that passes through three given points not on a line, a tangent line to a circle through a point on the circle, and a tangent line from a point outside a given circle to the circle.
- **G.CI.6:** Use tools to construct the inscribed and circumscribed circles of a triangle. Prove properties of angles for a quadrilateral inscribed in a circle.

Enduring Understandings

- Using precise terminology and definitions sets the stage for exploring more complex relationships in circles.
- There are a variety of angles, segments, and arcs that can be formed in a circle; knowing the relationships resulting from these pieces gives us tools to solve for different parts of a circle.
- Formulas for arc length and sector area give us the tools needed to examine slices of a circle.

Essential Questions

- Why is it important to define and understand so many relationships in a circle?
- In what settings would it be helpful to be able to calculate arc length? Sector area?
- How are circles similar to polygons? Different?

Key Concepts

- I can solve real-world problems involving circles and all their parts. (G.CI.4)
- I can use formulas to find missing arc lengths and related angles. (G.CI.4)
- I can precisely define angle using words, diagrams, and notation. (G.LP.2)
- I can precisely define circle using words, diagrams, and notation. (G.LP.2)

Related Concepts

- I can label all parts of a circle. (G.CI.1)
- I can solve problems involving tangent lines to circles. (G.CI.1)
- I can find measures of angles and arcs. (G.CI.1)
- I can determine whether an arc is a major arc or a minor arc. (G.CI.1)
- I can distinguish between chords, secants, and tangents. (G.CI.1)
- I can discuss concentric circles in terms of similarity. (G.CI.1)

Vocabulary

- Angle
- Arc
- Arc length
- Area of a circle
- Area of a sector
- Central angle
- Chord
- Circle
- Circumcenter
- Circumference
- Circumscribed angles
- Circumscribed Circle
- Congruent concentric circles

• I can precisely define line segment using words, diagrams, and notation. (G.LP.2) • I can precisely define parallel and perpendicular lines using words, diagrams, and notation. (G.LP.2) • I can explain what the undefined terms are and why they are undefined. (G.LP.2) • I can state the meaning of symbols and use them consistently and appropriately. (G.LP.2)	• Through exploration, I can derive the fact that the length of the arc intercepted by an angle is proportional to the radius. (G.CI.2) • Through exploration, I can derive the formula for the area of a sector. (G.CI.2) • I can find arc lengths. (G.CI.2) • I can use proportional relationships to find the area of sectors. (G.CI.2) • I can explore the relationship that exists between central, inscribed, and circumscribed angles. (G.CI.3) • I can determine the significance of the measure of an inscribed angle on a diameter and use that understanding to solve problems. (G.CI.3) • I can apply my understanding arcs, angles, and chords to solve circle related problems. (G.CI.3) • I can explore the relationship between a radius and a tangent when they are perpendicular at their intersection. (G.CI.3) • I can select an appropriate tool when asked to explain and justify geometric constructions. (G.CI.5) • I can construct the tangent line to a circle through a given exterior point. (G.CI.5) • I can construct the tangent line to a circle through a point on the circle. (G.CI.5) • I can justify my thinking when constructing tangents to a circle. (G.CI.5) • I can select an appropriate tool when asked to explain and justify geometric constructions. (G.CI.6) • I can construct an inscribed circle of a triangle. (G.CI.6) • I can construct a circumscribed circle of a triangle. (G.CI.6) • I can prove the properties of angles for a quadrilateral inscribed in a circle. (G.CI.6)	• Diameter • Geometric notation • Incenter • Inscribed angle • Inscribed Circle • Inscribed Quadrilateral • Intercepted arc • Line • Line Segment • Measure of an arc • Parallel Line • Perpendicular • Perpendicular Line • Plane • Point • Proportional • Radius • Secant • Similarity • Tangent • Undefined term

Mathematical Processes

- PS.5: Use appropriate tools strategically.
- PS.6: Attend precision.

Resources		
Proficiency Scales • G.CI.4 • G.LP.2	**Digital** • IDOE Examples/Tasks G.CI.4 • IDOE Examples/Tasks G.LP.2 • IDOE Examples/Tasks G.CI.1 • IDOE Examples/Tasks G.CI.2 • IDOE Examples/Tasks G.CI.3 • IDOE Examples/Tasks G.CI.5 • IDOE Examples/Tasks G.CI.6	**Manipulatives** • Compass • Desmos Geometry • Protractor • Scientific Calculator • Straight Edge • Straightedge

School Resources	
Textbook Module 10: Circles 10.1 Circles and Circumference: G.LP.2, G.CI.4 10.2 Measuring Angles and Arcs: G.CI.1, G.CI.2, G.CI.4 10.3 Arcs and Chords: G.CI.1, G.CI.3, G.CI.4 10.4 Inscribed Angles: G.CI.3, G.CI.6 10.5 Tangents: G.CI.1, G.CI.3, G.CI.5 10.6 Tangents, Secants, and Angle Measures: G.CI.1 10.7 Equations of Circles (SKIP or SAT REVIEW) 10.8 Equations of Parabolas (SKIP)	**Formative Assessments**

General Description of the Unit

In this final unit, students work with both 2-dimensional and 3-dimensional shapes. For 2-dimensional shapes, students will explore symmetries in polygons and will calculate the area of regular polygons and sectors of circles. For 3-dimensional shapes, students will create nets for the shapes and will examine the concepts symmetries, congruence, and similarity; additionally, they will use volume and surface area formulas for a variety of 3-dimensional shapes, including composite shapes, to solve both real-world and mathematical problems.

Priority Standards

- **G.TS.4:** Solve real-world and other mathematical problems involving volume and surface area of prisms, cylinders, cones, spheres, and pyramids, including problems that involve composite solids and algebraic expressions.
- **G.CI.4:** Solve real-world and other mathematical problems that involve finding measures of circumference, **areas of circles and sectors**, and arc lengths and related angles (central, inscribed, and intersections of secants and tangents).

Supporting Standards

- **G.QP.6:** Develop and use formulas for areas of regular polygons.
- **G.TS.1:** Create a net for a given three-dimensional solid. Describe the three-dimensional solid that can be made from a given net (or pattern).
- **G.TS.2:** Explore and use symmetries of three-dimensional solids to solve problems.
- **G.TS.3:** Explore properties of congruent and similar solids, including prisms, regular pyramids, cylinders, cones, and spheres and use them to solve problems.
- **G.CI.2:** Derive the fact that the length of the arc intercepted by an angle is proportional to the radius; derive the formula for the **area of a sector**.
- **G.QP.3:** Develop and use formulas to find measures of interior and exterior angles of polygons.

Additional Standards

- **G.TS.5:** Apply geometric methods to create and solve design problems.

Enduring Understandings

- The area of a regular polygon can be found by splitting the polygon into equal triangles and calculating the area of each triangle; the trigonometric ratios are often needed to find missing parts of the triangle.
- Nets provide an easy two-dimensional representation of a three-dimensional object. A net can aid in surface area calculation.
- Like two-dimensional objects, three-dimensional objects can also have one or more symmetries; they can also be congruent or similar to one another.
- Sometimes when calculating volume or surface area of a three-dimensional object, it is necessary to split the object into multiple pieces.
- Geometric properties, such as volume or surface area, are often utilized when designing new packaging or other objects; maximizing volume or minimizing surface areas are sometimes the goals.

Essential Questions

- What is a home improvement project where volume and surface area calculations would be necessary?
- How does right triangle trigonometry help calculate the area of a regular polygon?
- Is it possible to have more than one net for a three-dimensional object? Why or why not?
- How might a manufacturing business use properties of three-dimensional objects when designing a new product?

Key Concepts

- I can solve real-world problems involving circles and all their parts. (G.CI.4)
- I can use formulas to find missing arc lengths and related angles. (G.CI.4)
- I can calculate the volume of prisms, cylinders, pyramids, cones, and spheres. (G.TS.4)

Related Concepts

- Through exploration, I can derive the fact that the length of the arc intercepted by an angle is proportional to the radius. (G.CI.2)
- Through exploration, I can derive the formula for the area of a sector. (G.CI.2)
- I can find arc lengths. (G.CI.2)

Vocabulary

- Algebraic expression
- Apothem
- Arc length
- Area of a circle
- Area of a sector
- Central angle
- Circumference
- Composite solid
- Cone

• I can calculate the surface area of prisms, cylinders, pyramids, cones, and spheres. (G.TS.4) • I can apply the formula for the volume of solids to solve real-world problems. (G.TS.4) • I can apply the formula for surface area of solids to solve real-world problems. (G.TS.4) • I can solve mathematical problems involving volume and surface area of solids that includes algebraic expressions. (G.TS.4) • I can solve mathematical problems involving volume and surface area of composite solids. (G.TS.4)	• I can use proportional relationships to find the area of sectors. (G.CI.2) • I can conclude that the measures of the exterior angles of any polygon sum to 360° through exploration. (G.QP.3) • I can develop a strategy for finding the measure of a single exterior angle of a regular polygon. (G.QP.3) • I can find patterns and develop the formula for the sum of the measures of the interior angles of a polygon. (G.QP.3) • I can find the measure of a single angle in a regular polygon given the sum of the interior angles. (G.QP.3) • I can show the area of a regular polygon is the sum of the areas of the triangles that make it up. (G.QP.6) • I can develop the formula for finding the area of regular polygons and apply my understanding. (G.QP.6) • I can create nets for geometric solids. (G.TS.1) • I can describe the three-dimensional solid that can be made from a given net. (G.TS.1) • I can explore symmetries of three-dimensional solids. (G.TS.2) • I can solve problems involving symmetries of three-dimensional solids. (G.TS.2) • I can explore the properties of congruent solids, prisms, regular pyramids, cylinders, cones, and spheres. (G.TS.3) • I can explore the properties of similar solids, including prisms, regular pyramids, cylinders, cones, and spheres. (G.TS.3) • I can solve problems involving congruent and similar solids. (G.TS.3) • I can apply various geometric methods to create design problems (G.TS.5) • I can apply various geometric methods to solve design problems (G.TS.5)	• Congruent solid • Cylinder • Design • Exterior angle • Inscribed angle • Intercepted arc • Interior angle • Net • Polygon • Prism • Proportional • Pyramid • Regular polygon • Regular pyramid • Secant • Similar solid • Similarity • Sphere • Surface area • Tangent • Three-dimensional solid • Volume

Mathematical Processes

- PS.4 Model with mathematics.
- PS.6 Attend to precision.

Resources		
Proficiency Scales • G.CI.4 • G.TS.4	**Digital** • IDOE Examples/Tasks G.CI.4 • IDOE Examples/Tasks G.TS.4 • IDOE Examples/Tasks G.CI.2 • IDOE Examples/Tasks G.QP.3 • IDOE Examples/Tasks G.QP.6 • IDOE Examples/Tasks G.TS.1 • IDOE Examples/Tasks G.TS.2 • IDOE Examples/Tasks G.TS.3 • IDOE Examples/Tasks G.TS.5	**Manipulatives** • 3D Geometric Solids • Compass • Desmos Geometry • Graph Paper • Paper Net Layouts • Protractor • Scientific Calculator • Straight Edge • Virtual Cones • Virtual Cylinders • Virtual Graph Paper • Virtual Prisms • Virtual Pyramids

School Resources	
Textbook Module 11: Measurement 11.1 Areas of Quadrilaterals (SKIP or Optional Review) 11.2 Areas of Regular Polygons: G.QP.3, G.QP.6 11.3 Areas of Circles and Sectors: G.CI.2, G.CI.4 11.4 Surface Area: G.TS.1, G.TS.5 11.5 Cross Sections and Solids of Revolution: (SKIP) 11.6 Volume of Prisms and Pyramids: G.TS.4, G.TS.5 11.7 Volume of Cylinders, Cones, and Spheres: G.TS.4, G.TS.5 11.8 Applying Similarity to Solid Figures: G.TS.3, G.TS.5 11.9 Density (SKIP)	**Formative Assessments**