

# Unit 1: Foundations of Geometry

Content Area: **Mathematics**  
Course(s): **Geometry**  
Time Period: **September**  
Length: **6-8 weeks**  
Status: **Published**

## Unit Overview

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As this unit begins, students will strengthen their understanding of basic geometric terminology, points, lines, planes, distance and midpoint formulas, and angle relationships. Following this, students will carefully define parallel and perpendicular lines, and will review and solve problems based on the relationships that exist among them.

## Transfer

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Students will be able to independently use their learning to...

- Relate geometric terminology to real-world settings.
- Describe the relationships between basic geometric figures.
- Solve real-life and mathematical problems involving lines and angle relationships.
- Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

## Meaning

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## Understandings

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Students will understand that...

- The terms *point*, *line*, and *plane* are undefined terms upon which all other geometric concepts are based.
- The relationships that exist between specific angle pairs are used in solving for unknown measures.
- Specific angle relationships can be used to distinguish between parallel and non-parallel lines. Conversely, when parallel lines are intersected by a transversal, unique relationships exist between specific angle pairs.

## Essential Questions

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Students will continue to consider...

- How can geometric figures and their properties be described through careful use of geometric language?
- How can the unique properties of geometric figures be used to determine new information?

## **Application of Knowledge and Skill**

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### **Students will know...**

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- The meanings of basic geometric terminology and symbols.
- Postulates describing the relationships between points, lines, and planes.
- That bisectors divide angles or segments into two congruent parts.
- The distance and midpoint formulas.
- The relationships between linear pairs, vertical, supplementary, and complementary angles.
- That most rules in geometry come in the form of theorems, which are statements that have been proven.
- Which angle pairs are congruent and which are supplementary when parallel lines are intersected by a transversal.
- That specific angle relationships formed when two lines are intersected by a transversal can be used to show that two lines are parallel.
- The properties of perpendicular lines.

### **Students will be skilled at...**

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- Using geometric symbols and terminology correctly.
- Using given information and diagrams to make accurate conclusions about points, lines, and planes.
- Using the segment and angle addition postulates to write accurate equations and solve for unknowns.
- Using the relationships between linear pairs, vertical, supplementary, complementary, and bisected angles to write accurate equations and solve for unknowns.
- Writing simple geometric proofs involving basic angle relationships, parallel and perpendicular lines.
- Solving for unknowns when parallel lines and a transversal are given, writing and using equations as needed.
- Using known angle relationships to determine when two lines are parallel or perpendicular.

## **Academic Vocabulary**

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- acute angle
- adjacent angle
- alternate exterior angles
- alternate interior angles
- angle
- angle bisector
- area
- base
- between
- bisect
- collinear
- complementary angles
- conclusion
- congruent
- congruent angles
- congruent segments
- converse
- coplanar
- corresponding angles
- definition
- degree
- distance
- distance from a point to a line
- endpoint
- exterior of an angle
- interior of an angle
- length
- line
- linear pair
- measure
- midpoint
- obtuse angle
- opposite rays
- parallel lines
- parallel planes
- perpendicular bisector
- perpendicular lines
- plane
- point
- postulate
- ray
- right angle
- same-side exterior angles
- same-side interior angles
- segment
- segment bisector
- skew lines
- straight angle
- supplementary angles

- theorem
- transversal
- undefined term
- vertex
- vertical angles

## **Learning Goal 1.1**

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Students will use the undefined notions of point, line, plane, and distance along a line to develop definitions for angles, line segments, and rays, and will create and use sketches to solve problems involving angle and segment measures.

### **Daily Target 1.1.1 (Level of Difficulty: Retrieval, DOK: 1-Recall)**

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SWBAT identify, name, and sketch points, lines, segments, rays, and planes, as well as explain the basic relationships that exist among them.

MA.G-CO.A.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.
MA.K-12.6	Attend to precision.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

### **Daily Target 1.1.2 (Level of Difficulty: Comprehension, DOK: 2-Skill)**

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SWBAT calculate segment lengths and angle measures, as well as use the Segment and Angle Addition Postulates to solve for unknown measurements.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.G-CO.A.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.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.

### **Daily Target 1.1.3 (Level of Difficulty: Comprehension, DOK: 2-Skill)**

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SWBAT apply the distance and midpoint formulas to solve related problems.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.G-GPE.B.4	Use coordinates to prove simple geometric theorems algebraically.
MA.G-GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

### **Daily Target 1.1.4 (Level of Difficulty: Retrieval, DOK: 1-Recall)**

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SWBAT identify, classify, and measure angles and parts of angles.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.G-CO.A.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.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.

### **Daily Target 1.1.5 (Level of Difficulty: Analysis, DOK: 3-Strategic Thinking)**

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SWBAT identify adjacent, vertical, complementary, and supplementary angles, and will be able to use given information to solve for unknowns in related problems.

*\*\*Before moving to the next learning goal, have students complete the Chapter 1 test.\*\**

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

## Learning Goal 1.2

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Students will know and be able to apply theorems involving parallel lines, transversals, and perpendicular lines.

### Daily Target 1.2.1 (Level of Difficulty: Retrieval, DOK: 1-Recall)

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SWBAT define parallel and perpendicular lines, as well as describe and identify each of the following:

- parallel planes
- skew lines
- transversals
- corresponding angles
- alternate interior angles
- alternate exterior angles
- same-side interior angles
- same-side exterior angles

**Defining Parallel Lines:** <https://www.illustrativemathematics.org/content-standards/HSG/CO/A/1/tasks/1543>

**Defining Perpendicular Lines:** <https://www.illustrativemathematics.org/content-standards/HSG/CO/A/1/tasks/1544>

MA.G-CO.A.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.
MA.K-12.6	Attend to precision.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

### Daily Target 1.2.2 (Level of Difficulty: Knowledge Utilization, DOK: 4-Extended Thinking)

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SWBAT use theorems involving the angles formed by parallel lines and a transversals to justify conclusions and solve for unknown measures. Theorems should include:

- When a transversal crosses parallel lines, corresponding angles are congruent.
- When a transversal crosses parallel lines, alternate interior angles are congruent.
- When a transversal crosses parallel lines, alternate exterior angles are congruent.
- When a transversal crosses parallel lines, same-side interior angles are supplementary.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.

MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-CO.C.9	Prove theorems about lines and angles.
MA.K-12.8	Look for and express regularity in repeated reasoning.

### **Daily Target 1.2.3 (Level of Difficulty: Knowledge Utilization, DOK: 4-Extended Thinking)**

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SWBAT use angles formed when a transversal intersects coplanar lines to determine whether given lines are parallel, as well as use these relationships to solve for unknown measures. Theorems should include:

- If two coplanar lines are cut by a transversal so that alternate interior angles are congruent, then the two lines are parallel.
- If two coplanar lines are cut by a transversal so that alternate exterior angles are congruent, then the two lines are parallel.
- If two coplanar lines are cut by a transversal so that same-side interior angles are supplementary, then the two lines are parallel.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-CO.C.9	Prove theorems about lines and angles.
MA.K-12.8	Look for and express regularity in repeated reasoning.

### **21st Century Life and Careers**

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CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.

### **Technology**

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TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.

TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.12.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.1.12.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.12.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.
TECH.8.2.12.D.CS2	Use and maintain technological products and systems.

## **Formative Assessment and Performance Opportunities**

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- Academic Games
- Albert
- Carousel Activities
- Class Discussions
- Classwork
- Closure Activities
- Concept Sorting Activities
- Desmos Activities
- Do Nows
- Edpuzzle
- Edulastic
- Exit Tickets
- Four Corners Activities
- Graphic Organizers
- Homework
- Kahoot! Games
- Placemat Activities
- Question-All-Writes
- Quizizz Activities
- Quiz-Quiz-Trade Activities
- Station Activities
- Student Interviews
- Student Self-Ratings
- Teacher Observation
- Teacher Questioning



- Think, Pair, Share Discussions
- Thumbs Up/Down
- Turn and Talk Discussions
- Whip Around
- Whiteboard Use

## **Summative Assessment**

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- Projects
- Quizzes
- Tests
- Unit Exam

## **Accommodations and Modifications**

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- 504 Accommodations
- Challenge Problems
- Graphic Organizers
- Guided Notes
- IEP Modifications
- Learning Centers/Stations
- Leveled Practice Opportunities
- Projects
- Scaffolding Questions
- Small Group Instructions
- Student Companion Website Resources
- Technology
- Use of Manipulatives (Paper Strips, Exploragons, etc.)

## **Unit Resources**

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- Albert
- Desmos
- Geometer's Sketchpad
- Google Classroom
- Kahoot!

- Kuta Software
- Loom
- Quizizz
- Textbook: Geometry, Common Core Ed. (Holt McDougal, 2012)
- Textbook Resource Kit & Companion Website: <https://my.hrw.com/>
- Youtube

#### Additional Websites:

- Albert: [albert.io](http://albert.io)
- Dan Meyer's 3-Act Math  
Tasks: <https://docs.google.com/spreadsheets/pub?key=0AjIqyKM9d7ZYdEhtR3BJMmdBWnM2YWxWYVM1UWowTEE&output=htmlG>
- Engage NY: Geometry Lesson Notes & Handouts: <https://www.engageny.org/resource/high-school-geometry>
- Geometry Teacher Mike Patterson's Common Core Teaching Notes: <http://www.geometrycommoncore.com/>
- Khan Academy: <https://www.khanacademy.org/>
- NCTM Illuminations Website: Resources for Teaching Math: <http://illuminations.nctm.org/Default.aspx>
- PARCC Educator Resources: <http://www.parcconline.org/for-educators>
- The Geometer's Sketchpad Resource Center: <http://www.dynamicgeometry.com/>

## Interdisciplinary Connections

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- City Designer Project
- Curve Stitching
- Origami
- Parallel City Project

VA.6-8.1.5.8.Cr2c	Apply, organize and strategize methods for design and redesign of objects, places, systems, images and words to clearly communicate information to a diverse audience.
VA.6-8.1.5.8.Cr3a	Use criteria to examine, reflect on and plan revisions for a work of art, and create an artistic statement.
VA.9-12.1.5.12prof.Pr5	Developing and refining techniques and models or steps needed to create products.
VA.9-12.1.5.12prof.Pr5a	Analyze and evaluate the reasons and ways an exhibition is presented.
SOC.9-12.1.2.1	Construct various forms of geographic representations to show the spatial patterns of physical and human phenomena.