

# Unit 1: Reasoning & Proof

Content Area: **Mathematics**  
Course(s): **Geometry, Honors Geometry**  
Time Period: **September**  
Length: **2 weeks**  
Status: **Published**

## Unit Overview

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- Analyze a biconditional statement.
- Apply the laws of logic to geometric statements.
- Justify the steps in solving an equation by using properties from algebra.
- Predict the next figure or item in the pattern.
- Provide examples of conditionals and counterexamples.
- Use inductive reasoning to make a conjecture
- Using a two column format prove the solution to an algebraic equation using properties of equality.

## Enduring Understandings

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- Spatial relationships can be clearly described with geometric properties
- Valid argument and presentation of clearly conclusive evidence is essential to writing a proof.

## Essential Questions

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- How are geometric properties used in proofs?
- How are undefined terms incorporated in geometric properties?
- What are possible proof formats?
- What are valid justifications in proofs and why are they necessary?

## Student Learning Objectives

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- Identify the hypothesis and conclusion of a conditional statement
- Justify steps when solving equations
- Use inductive reasoning to make a conjecture
- use properties of equality to prove a solution to an equation
- write a biconditional statement
- Write a conditional statement
- write a counterexample to disprove a conditional statement
- Write a definition as a biconditional statement
- write a two column proof
- write the converse of a conditional statement

## Standards

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Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

MA.G-CO.C

Prove geometric theorems

Connections to Equations.

## Indicators

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MA.G-CO.C.9

Prove theorems about lines and angles.

MA.G-GPE.B.4

Use coordinates to prove simple geometric theorems algebraically.

The correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof.

## Lesson Titles

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- Conditional Statements

- Converse and Biconditional Statements
- Inductive Reasoning
- Introduction to Proofs

## Career Readiness, Life Literacies & Key Skills

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TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).
TECH.9.4.2.TL.2	Create a document using a word processing application.
TECH.9.4.2.TL.3	Enter information into a spreadsheet and sort the information.

## Inter-Disciplinary Connections

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LA.RL.9-10.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.RL.9-10.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).
LA.RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.) and make relevant connections, to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
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.
LA.RI.9-10.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).
LA.WHST.9-10.1.E	Provide a concluding paragraph or section that supports the argument presented.
ARCH.9-12.9.4.12.B.(1).3	Integrate structural, environmental, safety, building envelope, and building service systems in the design of buildings and structures.

## Instructional Strategies. Learning Activities. and Levels of Blooms/DOK:

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- Demonstrate how to solve algebraic proofs
- Demonstrate how to solve basic congruence proofs
- Intro. applying special angles to proofs
- Intro. biconditional statements
- Intro. complementary angles

- Intro. Conclusions
- Intro. Conditional Statements
- Intro. Converse statements
- Intro. counterexamples
- Intro. finding measures of missing angles using theorems of special angles
- Intro. finding angle measurement with perpendicular lines
- Intro. Hypothesis
- Intro. perpendicular lines
- Intro. planning a proof
- Intro. proofs and how to use them to solve problems
- Intro. properties of congruence
- Intro. proving theorems
- Intro. reasons used in proofs
- Intro. students to algebraic proofs
- Intro. supplementary angles
- Intro. the Angle Bisector theorem
- Intro. the midpoint theorem
- Intro. theorems of perpendicular lines
- Intro. vertical angles
- Intro. what you can deduce from given information
- make connections between verbal statements and equations
- make connections definitions and equality statements-analyze given information
- Review anticipatory Set
- Review Homework
- Review properties of equality from algebra
- Review Quiz
- Review standardized-test practice questions for warmup
- students will be introduced to the concept of deductive reasoning
- Students will work independently on developing deductive reasoning skills
- Students will work independently on solving problems involving complementary and supplementary angles
- use mathematical properties to deduce new informationstandards

## **Modifications:**

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## **G&T Modifications**

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- Ask students' higher level questions that require students to look into causes, facts to draw a conclusion or make connections to other areas of learning.
- CTE - Additional reinforcement activities soliciting a deeper understanding of curriculum.
- Employ differentiated curriculum to keep interest high.
- Generating and testing hypotheses
- Tutoring during Delsea One

## **ELLs Modifications**

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- 1:1 testing
- Digital translators
- Focus on domain specific vocabulary and keywords
- Offer alternate/or modify assessments
- Tutoring during Delsea One

## **IEP & 504 Modifications**

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- Cue Attention
- Extra time
- Family Communication
- Focus on domain specific vocabulary and keywords
- Frequent Check of Work/Reminders
- Modify homework expectations
- Preferential Seating
- Provide Study Guides/Notes
- providing students with content vocabulary prior to teaching a lesson including that vocabulary (pre-teaching)
- Repeat/Reword/Clarify
- Small group testing
- State Expectations Clearly
- Tutoring during Delsea One
- Use of calculator

## **At Risk Modifications**

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- Additional help during tutoring/Delsea One/Academic Enrichment
- Family Communication
- Retesting
- Study Guides

- Tutoring during Delsea One

## **Formative Assessment**

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- anticipatory set
- closure
- group work
- pass out of class
- think-pair-share
- warm up

## **Alternate Assessments**

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Performance tasks

Project-based assignments

Problem-based assignments

Presentations

## **Benchmark Assessment**

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Skills-based assessment- math practice

## **Summative Assessment**

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- Alternate Assessment
- Marking Period Assessment
- Test inductive reasoning, conjecturing, algebraic proofs and introduction to geometric proofs
- Vocab Assessment

## **Resources & Technology**

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## Resources and Materials

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- Geometry Text Book- McDougal – Littell
- Manipulatives
- Protractor
- Ruler
- Study Guide and Practice Sheet – Glencoe/McGraw Hill
- Teacher Created worksheets
- Teacher Generated worksheets

## Technology

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- deltamath.com
- desmos.com
- edpuzzle.com
- Geometer sketchpad
- Gimkit.com
- IXL.com
- Kahoot.com
- Mathxl
- Peardeck
- Smart Board
- Ti-84 calculator
- Videos

TECH.8.1.12

Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

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.