

Unit 4: Introduction to Geometry

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **10-12 Weeks**
Status: **Published**

Unit Rationale

An **Introduction to Geometry** unit in Algebra 1 is vital for establishing a foundational understanding of geometric principles and their applications. Geometry often overlaps with algebraic concepts, and a strong grasp of geometry enhances students' overall mathematical proficiency. Here's a detailed rationale for including an Introduction to Geometry unit:

1. Foundation for Mathematical Understanding

- **Basic Geometric Principles:** Geometry introduces students to fundamental concepts such as points, lines, angles, and shapes. Understanding these concepts is crucial for solving problems in algebra and other areas of mathematics.
- **Connection to Algebra:** Many geometric concepts, such as coordinate geometry and geometric transformations, have direct applications in algebra. Exploring these connections helps students see the relevance of geometric principles in algebraic contexts.

2. Development of Spatial Reasoning

- **Visualization Skills:** Geometry helps students develop spatial reasoning skills, which are essential for understanding and solving problems involving shapes and spatial relationships.
- **Shape Properties:** Learning about different shapes (triangles, quadrilaterals, circles) and their properties enables students to recognize and work with geometric figures effectively.

3. Introduction to Proof and Logical Reasoning

- **Reasoning and Proof:** Geometry introduces the concept of mathematical proof, including direct proofs and proofs by contradiction. This enhances students' logical reasoning and argumentation skills, which are important for all areas of mathematics.
- **Geometric Relationships:** Understanding how to prove geometric relationships and theorems develops students' ability to think critically and justify their reasoning.

4. Real-World Applications

- **Practical Problems:** Geometry is used to solve real-world problems involving measurements, construction, design, and optimization. Students learn to apply geometric principles to practical scenarios, such as calculating areas, volumes, and distances.
- **Technology and Design:** Knowledge of geometry is essential in fields such as architecture, engineering, and graphic design. This unit provides a foundation for understanding how geometric principles are applied in various professions.

5. Preparation for Advanced Topics

- **Algebraic Geometry:** Understanding the basics of geometry prepares students for more advanced topics such as coordinate geometry, trigonometry, and calculus. Geometry concepts are foundational

for studying these more complex mathematical areas.

- **Integration with Algebra:** Introducing geometric concepts in algebra helps students integrate and apply their knowledge of algebraic equations to geometric problems, enhancing their overall mathematical skills.

6. Development of Critical Thinking and Problem-Solving Skills

- **Problem-Solving Techniques:** Geometry encourages students to explore and apply different problem-solving techniques, such as using formulas, creating diagrams, and reasoning through spatial relationships.
- **Critical Thinking:** Working with geometric problems develops students' critical thinking skills, as they must analyze situations, apply geometric principles, and draw logical conclusions.

7. Enhancing Mathematical Literacy

- **Mathematical Vocabulary:** Geometry introduces students to important mathematical terminology and notation, helping them become more fluent in mathematical language.
- **Visual Representation:** Understanding how to represent geometric concepts visually supports students' ability to interpret and communicate mathematical ideas effectively.

8. Preparation for Standardized Testing

- **Test Preparation:** Geometry is a significant component of standardized tests. Proficiency in geometric concepts and problem-solving is essential for performing well on tests such as the SAT, ACT, and state assessments.

Including an **Introduction to Geometry** unit in Algebra 1 provides students with essential geometric knowledge and skills, enhances their mathematical reasoning, and prepares them for more advanced topics. This unit supports students' overall mathematical development and helps them apply geometric principles to real-world problems and future mathematical studies.

Topic 6 Foundations of Geometry

Essential Questions

What are some of the fundamentals of geometry?

How are the properties of segments and angles used to determine their measures?

How are a straightedge and compass used to make basic constructions?

How are the midpoint and length of a segment on a coordinate plane determined?

How is inductive reasoning used to recognize mathematical relationships?

How do if-then statements describe mathematical relationships?

How is deductive reasoning different from inductive reasoning?

How is deductive reasoning used to prove a theorem?

What can you conclude when valid reasoning leads to a contradiction?

Pre-Assessments

Topic Readiness Assessments available at [SavvasRealize.com](https://www.savvasrealize.com)

Instructional Plan

Lesson 6.1 Measuring Segments and Angles

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to use the ruler and segment addition postulates.
- We are learning to use the protractor and the angle addition postulates.
- We are learning to identify congruent segments and congruent angles.

Student Success Criteria ... “I can statements”

- I can use the properties of segments and angles to find their measures.

Instructional Strategies and Activities

- Habits of Mind: Why are the appropriate symbols important to use? Why should you always draw a diagram for geometric statements?
- Student textbook pages 219-227
- Vocabulary: colinear points, line, plane, point, postulate, irrational number, rational number, real number

Formative Assessments

- 6-1 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-1
- Additional Practice 6-1
- Enrichment 6-1
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 9-27, 30-41; Advanced 9-20, 23-41

Reflections and Suggested Modifications

Common Error: How to properly use a protractor making sure that the vertex is aligned with the hole in the middle of the protractor being "0" and the "end" of the ray. Length is always a positive number. If there is a negative value, the measurement will not be negative. Absolute value is the distance, you find the distance by finding the difference between two values.

Lesson 6.2 Basic Constructions

Student Learning Intentions or We are learning to ... (WALT)

- We are able to construct copies of segment and angles, perpendicular bisectors of segments, and bisectors of angles.
- We are able to apply construction to solve problems.

Student Success Criteria ... "I can statements"

- I can use a straightedge and compass to construct basic figures.

Instructional Strategies and Activities

- Habits of Mind: What mathematical terms or concepts can you use to describe your design? How is constructing a perpendicular bisector similar to constructing an angle bisector?
- Student textbook page 228-235
- Vocabulary: angle bisector, construction, perpendicular bisector

Formative Assessments

- 6-2 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-2
- Additional Practice 16-2
- Enrichment 6-2
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 10-19, 21-25; Advanced 10-14, 16-29

Reflections and Suggested Modifications

Common Error: When building constructions, a ruler is only used as a straightedge, not a measuring tool. Once your compass is set, do not reset it (make sure compasses are set tightly). Students should be familiar not just how to do it but the steps involved as there is often a construction question on standardized tests NJSLA./NJGPA

[Geometric Constructions Guide](#)

Lesson 6.3 Midpoint and Distance

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to use the midpoint formula to find the midpoint of a segment drawn on a coordinate plane.
- We are learning to use the distance formula to find the length of segment drawn on the coordinate plane.

Student Success Criteria ... “I can statements”

- I can use the midpoint and distance formulas to solve problems.

Instructional Strategies and Activities

- Habits of Mind: What tools did you use to help you answer the questions? Why was it helpful to use the tools you did?
- Student textbook page 236-241
- Vocabulary: midpoint, pythagorean theorem

Formative Assessments

- 6-3 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-3
- Additional Practice 6-3
- Enrichment 6-3
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 9-21, 23-28; Advanced 9-16, 28-28

Reflections and Suggested Modifications

Common Error: Students need to find the horizontal distance and the vertical distance and not subtract x coordinate values and y coordinate values. Linking it to the pythagorean theorem allows them to link triangles to the coordinate grid. Fraction distance is a commonly tested questions- students need to decided if they are adding the fraction to the vertical and horizontal distances. It should be added to the endpoint. Showing examples of this and reviewing understanding of fractions is helpful to decrease the learning gap.

Lesson 6.4 Inductive Reasoning

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to use inductive reasoning to identify patterns and make predictions based on data.
- We are learning to use inductive reasoning to prove evidence that conjectures are true or provide counterexamples to disprove them.

Student Success Criteria ... “I can statements”

- I can use inductive reasoning to make conjectures about mathematical relationships.

Instructional Strategies and Activities

- Habits of Mind: What strategies can you use to find patterns in numbers presented in a sequence or a table? What strategies can you use to find patterns with dots or other visual patterns? Does an observation of a pattern always prove a relationship?
- Student textbook page 242-248
- Vocabulary: conjecture, counterexample, inductive reasoning, sequence

Formative Assessments

- 6-4 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-4
- Additional Practice 6-4
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 7-23; Advanced 7-23

Reflections and Suggested Modifications

Common Error: Students may not test zero or one as cases for the conjecture, or they may only test even numbers after testing one. Remind students that integers include zero and negative numbers.

Lesson 6.5 Conditional Statements

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to write conditional and biconditional statements.
- We are learning to find the contrapositive, converse, and inverse of a conditional statement.
- We are learning to find truth values for conditional statements and complete truth tables.

Student Success Criteria ... “I can statements”

- I can write conditionals and biconditionals and find their truth values.

Instructional Strategies and Activities

- Habits of Mind:
- Student textbook page 250-257
- Vocabulary: biconditional, conclusion, conditional, contrapositive, converse, hypothesis, inverse, negation, truth table, truth value

Formative Assessments

- 6-5 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-5
- Additional Practice 16-5
- Enrichment 101
- Math Literacy and Vocabulary

- Digital Resources and Video Tutorials
- Assignment Guide: Basic 11-31, 33-38; Advanced 11-18, 20-38

Reflections and Suggested Modifications

Common Error: Students may confuse converse and inverse. Help them remember by telling them that convert, a word related to converse, means change around. Also, the prefix in means no as in indigestible, inaccurate, inexpensive. Students may struggle to identify the hypothesis and the conclusion in the statement because it is not written in if-then form. Remind students that since the statement is a biconditional, it does not matter which phrase is chosen as a hypothesis or conclusion.

Lesson 6.6 Deductive Reasoning

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to use deductive reasoning to draw a valid conclusion based on a set of given facts.

Student Success Criteria ... “I can statements”

- I can use deductive reasoning to draw conclusions.

Instructional Strategies and Activities

- Habits of Mind: You have used the word hypothesis and conclusion in other classes. How are their meanings the same as or different from the definition in geometry?
- Student textbook pages 258-264
- Vocabulary: deductive reasoning, Law of Detachment, Law of Syllogism

Formative Assessments

- 6-6 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-6
- Additional Practice 6-6
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 9-19, 21-28; Advanced 9-14, 16-28

Reflections and Suggested Modifications

Common Error: Students are given only one conditional statement, they may think it is not possible to reach a valid conclusions.

Lesson 6.7 Writing Proofs

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to use deductive reasoning to prove geometric theorems about lines and angles.

Student Success Criteria ... “I can statements”

- I can learning to use deductive reasoning to prove theorems.

Instructional Strategies and Activities

- Habits of Mind: What ideas have you learned before that were useful in evaluating William's solutions? What steps can you take to verify that each solution is correct?
- Student textbook page 265-271
- Vocabulary: paragraph proof, linear pair, proof, theorem, two-column proof, division property of equality, multiplication property of equality

Formative Assessments

- 6-7 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-7
- Additional Practice 6-7
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 9-26; Advanced 9-26

Reflections and Suggested Modifications

Common Error: Many students may find the correct value of the variable but forget to find the measures of the labeled angles.

Lesson 6.8 Indirect Proof

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to understand and use indirect reasoning to prove or disprove propositions and theorems.
- We are learning to write indirect proofs.

Student Success Criteria ... “I can statements”

- I can use indirect reasoning to write a proof.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 272-277
- Vocabulary: indirect proof

Formative Assessments

- 6-8 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-8
- Additional Practice 6-8
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 11-28, Advanced 11-28

Reflections and Suggested Modifications

Common Error: Students may think that the negation of perpendicular is parallel and students need to draw a diagram to help support their thinking.

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Gifted, At-risk of Failure)

English Language Learners

*SCIOP/WIDA levels will allow the teacher to determine what supports are appropriate. Reach out to the MLL teacher for suggestions.

Native language support: The teacher provides auditory or written content to students in their native language. [Sentence Stems](#)

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front-loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

*Always reference the students IEP for specific accommodations or modification per student need.

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

*Always reference the students IEP for specific accommodations or modification per student need.

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

*Reach out to the Student Support team for assistance.

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes

here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.

Topic 7 Parallel and Perpendicular Lines

Essential Questions

What properties are specific to parallel lines and perpendicular lines?

What angle relationships are created when parallel lines are intersected by a transversal?

What angle relationships can be used to prove that two lines intersected by a transversal are parallel?

What is true about the interior and exterior angle measures of a triangle?

How do the slopes of lines that are parallel to each other compare? How do the slopes of lines that are perpendicular to each other compare?

Pre-Assessments

Topic Readiness Assessments available at [SavvasRealize.com](https://www.savvasrealize.com)

Instructional Plan

Lesson 7.1 Properties of Parallel Lines

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to define parallel lines using the undefined terms point and line.
- We are learning to prove theorems about lines and angles
- We are learning to use theorems to find the measures of angles formed by parallel lines and a transversal.

Student Success Criteria ... “I can statements”

- I can determine the measures of the angles formed when parallel lines are intersected by a transversal.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 285-291
- Vocabulary: none

Formative Assessments

- 7-1 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 7-1
- Additional Practice 7-1
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide:

Reflections and Suggested Modifications

Common Error:

Lesson 7.2 Proving Lines Parallel

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to prove that two lines cut by a transversal are parallel using the converses of parallel line angle relationship theorems.
- We are learning to use properties of parallel lines and transversal to solve real-world and mathematical problems.
- We are learning to write and use flow proofs.

Student Success Criteria ... “I can statements”

- I can use angle relationships to prove that lines and parallel

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 292-298
- Vocabulary: flow proof

Formative Assessments

- 7-2 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 7-2
- Additional Practice 7-2
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide:

Reflections and Suggested Modifications

Common Error:

Lesson 7.3 Parallel Lines and Triangles

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to use lines constructed parallel to another line to solve problems and prove theorems.

- We are learning to use the sum of the angle measures in a triangle to solve problems.

Student Success Criteria ... “I can statements”

- I can solve problems using the measures of interior and exterior angles of triangles.

Instructional Strategies and Activities

- Habits of Mind:
- Student textbook page 299-305
- Vocabulary:

Formative Assessments

- 7-3 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 7-3
- Additional Practice 7-3
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide:

Reflections and Suggested Modifications

Common Error:

Lesson 7.4 Slopes of Parallel and Perpendicular Lines

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to show that two lines in the coordinate plane are parallel by comparing their slopes, and solve problems.
- We are learning to show that two lines in the coordinate plane are perpendicular by comparing their slopes, and use that information to solve problems.

Student Success Criteria ... “I can statements”

- I can

Instructional Strategies and Activities

- Habits of Mind:

- Student textbook page 306-312
- Vocabulary:

Formative Assessments

- 7-4 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 7-4
- Additional Practice 7-4
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide:

Reflections and Suggested Modifications

Common Error:

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Gifted, At-risk of Failure)

English Language Learners

**SCIOP/WIDA levels will allow the teacher to determine what supports are appropriate. Reach out to the MLL teacher for suggestions.*

Native language support: The teacher provides auditory or written content to students in their native language. The use of [sentence stems](#) is a great support.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front-loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

*Always reference the students' IEP for specific accommodations or modifications per student need.

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Classwork such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

*Always reference the students IEP for specific accommodations or modifications per student need.

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, apply acquired knowledge, and/or produce something about acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for

those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

*Reach out to the Student Support team for assistance.

Directions or instructions: make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in a simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk can complete it?" Sometimes you'll simplify the task, reduce the length of the assignment, or allow for a different mode of delivery. For instance, many students may hand something in, and the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or need some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch, and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight

issues need to be close to the instruction which often means near the front.

Topic 8 Transformations

Pre-Assessments

Topic Readiness Assessments available at [SavvasRealize.com](https://www.savvasrealize.com)

Essential Questions

What are properties of the four types of rigid motion?

How are the properties of reflection used to transform a figure?

What are the properties of translation?

What are the properties that identify a rotation?

How can rigid motions be classified?

How can you tell whether a figure is symmetric?

Instructional Plan

Lesson 8.1 Reflections

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to find a reflected image and write a rule for a reflection.

- We are learning to define reflection as a transformation across a line of reflection with given properties and perform reflections on and off a coordinate grid.

Student Success Criteria ... “I can statements”

- I can draw and describe the reflection of a figure across a line of reflection.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 319-326
- Vocabulary: indirect proof

Formative Assessments

- 8-1 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 8-1
- Additional Practice 8-1
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic

Reflections and Suggested Modifications

Common Error:

Lesson 8.2 Translations

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to translate a figure and write a rule for a translation.
- We are learning to find the image of a figure after a composition or rigid motions.
- We are learning to prove that a translation is a composition of two reflections.

Student Success Criteria ... “I can statements”

- I can describe the properties of a figure before and after translation.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 327-334
- Vocabulary: composition of rigid motions.

Formative Assessments

- 8-2 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 8-2
- Additional Practice 8-2
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic

Reflections and Suggested Modifications

Common Error:

Lesson 8.3 Rotations

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to rotate a figure and write a rule for a rotation.
- We are learning to prove that a rotation can be written as the composition of two reflections.

Student Success Criteria ... “I can statements”

- I can draw and describe the rotation of a figure about a point of rotation for a given angle of rotation.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 335-342
- Vocabulary: indirect proof

Formative Assessments

- 8-3 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 8-3
- Additional Practice 8-3
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic

Reflections and Suggested Modifications

Common Error:

Lesson 8.4 Classification of Rigid Motions

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to specify a sequence of transformations that will carry a given figure onto another.
- We are learning to use geometric descriptions of rigid motions to transform figures.
- We are learning to identify types of symmetry in a figure.

Student Success Criteria ... “I can statements”

- I can identify different rigid motions used to transform two-dimensional shapes.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 343-349
- Vocabulary: glide reflection

Formative Assessments

- 8-4 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 8-4
- Additional Practice 8-4

- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic

Reflections and Suggested Modifications

Common Error:

Lesson 8.5 Symmetry

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to describe rotations and/or reflections that carry a polygon onto itself.
- We are learning to predict the effect of a given rigid motion on a figure.
- We are learning to identify types of symmetry in a figure.

Student Success Criteria ... “I can statements”

- I can identify different types of symmetry in two-dimensional figures.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 350-355
- Vocabulary: point symmetry, reflectional symmetry, rotational symmetry

Formative Assessments

- 8-5 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 8-5
- Additional Practice 8-5
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic

Reflections and Suggested Modifications

Common Error:

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Gifted, At-risk of Failure)

English Language Learners

*SCIOP/WIDA levels will allow the teacher to determine what supports are appropriate. Reach out to the MLL teacher for suggestions.

Native language support: The teacher provides auditory or written content to students in their native language. [Sentence Stems](#)

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front-loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

*Always reference the students IEP for specific accommodations or modification per student need.

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

*Always reference the students IEP for specific accommodations or modification per student need.

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

*Reach out to the Student Support team for assistance.

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.

Topic 9 Triangle Congruence

Essential Questions

What relationships between sides and angles of triangles can be used to prove triangles are congruent?

What is the relationship between rigid motions and congruence?

How are the side lengths and angle measures related in isosceles triangles and in equilateral triangles?

How are SAS and SSS used to show that two triangles are congruent?

How are ASA and AAS used to show that triangles are congruent?

What minimum criteria are needed to show that right triangles are congruent?

Which theorems can be used to prove that two overlapping triangles are congruent?

How are the properties of geometric figures represented in the coordinate plane?

How are chords related to their central angles and intercepted arcs?

Pre-Assessments

Topic Readiness Assessments available at [SavvasRealize.com](https://www.savvasrealize.com)

Instructional Plan

Lesson 9.1 Congruence

Student Learning Intentions or We are learning to ... (WALT)

- We are

Student Success Criteria ... “I can statements”

- I can use composition of rigid motions to show that two objects are congruent.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 363-370
- Vocabulary: congruence transformation, congruent

Formative Assessments

- 9-1 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 9-1
- Additional Practice 9-1
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic

Reflections and Suggested Modifications

Common Error:

Lesson 9.2 Isosceles and Equilateral Triangles

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to understand and use indirect reasoning to prove or disprove propositions and theorems.
- We are learning to write indirect proofs.

Student Success Criteria ... “I can statements”

- I can use indirect reasoning to write a proof.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 272-277
- Vocabulary: indirect proof

Formative Assessments

- 6-8 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-8
- Additional Practice 6-8
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 11-28, Advanced 11-28

Reflections and Suggested Modifications

Common Error: Students may think that the negation of perpendicular is parallel and students need to draw a diagram to help support their thinking.

Lesson 9.3 Proving and Applying the SAS and SSS Congruence Criteria

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to understand and use indirect reasoning to prove or disprove propositions and theorems.
- We are learning to write indirect proofs.

Student Success Criteria ... “I can statements”

- I can use indirect reasoning to write a proof.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 272-277
- Vocabulary: indirect proof

Formative Assessments

- 6-8 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-8
- Additional Practice 6-8
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 11-28, Advanced 11-28

Reflections and Suggested Modifications

Common Error: Students may think that the negation of perpendicular is parallel and students need to draw a diagram to help support their thinking.

Lesson 9.4 Proving and Applying the ASA and AAS Congruence Criteria

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to understand and use indirect reasoning to prove or disprove propositions and theorems.
- We are learning to write indirect proofs.

Student Success Criteria ... “I can statements”

- I can use indirect reasoning to write a proof.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 272-277
- Vocabulary: indirect proof

Formative Assessments

- 6-8 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-8
- Additional Practice 6-8
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 11-28, Advanced 11-28

Reflections and Suggested Modifications

Common Error: Students may think that the negation of perpendicular is parallel and students need to draw a diagram to help support their thinking.

Lesson 9.5 Congruence in Right Triangles

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to understand and use indirect reasoning to prove or disprove propositions and theorems.
- We are learning to write indirect proofs.

Student Success Criteria ... “I can statements”

- I can use indirect reasoning to write a proof.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 272-277
- Vocabulary: indirect proof

Formative Assessments

- 6-8 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-8
- Additional Practice 6-8
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 11-28, Advanced 11-28

Reflections and Suggested Modifications

Common Error: Students may think that the negation of perpendicular is parallel and students need to draw a diagram to help support their thinking.

Lesson 9.6 Congruence in Overlapping Triangles

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to understand and use indirect reasoning to prove or disprove propositions and theorems.
- We are learning to write indirect proofs.

Student Success Criteria ... “I can statements”

- I can use indirect reasoning to write a proof.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 272-277
- Vocabulary: indirect proof

Formative Assessments

- 6-8 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-8
- Additional Practice 6-8
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 11-28, Advanced 11-28

Reflections and Suggested Modifications

Common Error: Students may think that the negation of perpendicular is parallel and students need to draw a diagram to help support their thinking.

Lesson 9.7 Polygons in the Coordinate Plane

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to understand and use indirect reasoning to prove or disprove propositions and theorems.
- We are learning to write indirect proofs.

Student Success Criteria ... “I can statements”

- I can use indirect reasoning to write a proof.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?
- Student textbook page 272-277
- Vocabulary: indirect proof

Formative Assessments

- 6-8 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-8
- Additional Practice 6-8
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 11-28, Advanced 11-28

Reflections and Suggested Modifications

Common Error: Students may think that the negation of perpendicular is parallel and students need to draw a diagram to help support their thinking.

Lesson 9.8 Chords

Student Learning Intentions or We are learning to ... (WALT)

- We are learning to understand and use indirect reasoning to prove or disprove propositions and theorems.
- We are learning to write indirect proofs.

Student Success Criteria ... “I can statements”

- I can use indirect reasoning to write a proof.

Instructional Strategies and Activities

- Habits of Mind: How did you determine which operations are needed to solve the problem?

- Student textbook page 272-277
- Vocabulary: indirect proof

Formative Assessments

- 6-8 Lesson Quiz (printable or available online)

Instructional Materials and Resources

- enVisions Math
- Reteach to Build Understanding 6-8
- Additional Practice 6-8
- Enrichment 101
- Math Literacy and Vocabulary
- Digital Resources and Video Tutorials
- Assignment Guide: Basic 11-28, Advanced 11-28

Reflections and Suggested Modifications

Common Error: Students may think that the negation of perpendicular is parallel and students need to draw a diagram to help support their thinking.

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Gifted, At-risk of Failure)

English Language Learners

*SCIOP/WIDA levels will allow the teacher to determine what supports are appropriate. Reach out to the MLL teacher for suggestions.

Native language support: The teacher provides auditory or written content to students in their native language. [Sentence Stems](#)

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front-loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

*Always reference the students IEP for specific accommodations or modification per student need.

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

*Always reference the students IEP for specific accommodations or modification per student need.

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

*Reach out to the Student Support team for assistance.

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.

Standards Addressed

New Jersey Student Learning Standards: Content Area

MATH.K-12.1	Make sense of problems and persevere in solving them
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.3	Construct viable arguments and critique the reasoning of others
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically
MATH.9-12.G.CO	Congruence
MATH.9-12.G.CO.A	Experiment with transformations in the plane
MATH.K-12.6	Attend to precision
MATH.K-12.8	Look for and express regularity in repeated reasoning
MATH.9-12.G.CO.C	Prove geometric theorems
MATH.9-12.G.CO.D	Make geometric constructions
MATH.9-12.G.GPE	Expressing Geometric Properties with Equations
MATH.9-12.G.GPE.B.4	Use coordinates to prove simple geometric theorems algebraically.

21st Century Life and Career

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Integration of Computer Science and Design Thinking

CS.9-10.3A-AP-14	Use lists to simplify solutions, generalizing computational problems instead of repeatedly using simple variables.
CS.9-10.3A-AP-17	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

Interdisciplinary Connections: NJSL for ELA, Social Studies, Science and/or Math

SOC.K-12.4	Developing Claims and Using Evidence
------------	--------------------------------------

SOC.K-12.5	Presenting Arguments and Explanations
ELA.K-12.W.IW	Informative and Explanatory Writing: By the end of grade 12, write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
ELA.K-12.SL.UM	Use Media: By the end of grade 12, make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media Literacy

Diversity, Equity, and Inclusion

[NCTM: Access and Equity in Mathematics Education](#)

[A Pathway to Equitable Math Instruction](#)

Provide students with opportunities to give feedback to teachers about the classroom and instruction.

- Verbal Example: Fist to five, How well do you understand what we talked about today? Fist to five, How well did I teach this today?
- Classroom Activity: Exit tickets or surveys that ask students to identify how well teachers taught, what helped them learn, what got in the way of their learning, etc.

Treat mathematics as a language that everyone is learning while authentically centering students home languages.

- Classroom Strategies: Color-coding ideas, learning vocabulary in student languages, visual and kinesthetic learning, representations of learning without words.
- Classroom Activity: Multilingual Frayer Models for definitions or concepts

Incorporate true culturally relevant pedagogy, practice, and curriculum.

- Verbal Example: What are some of your family traditions that you are proud of? Would you be okay if we brought some of those into the classroom?
- Classroom Activity: Use Ankara fabric to teach mathematical concepts such as tessellations, fractions, area, percentages, etc.

Incorporate the history of mathematics into lessons.

- Verbal Example: Why do you think we call it Pythagorean's theorem, when it was used before he was even born? What should we call it instead?
- Classroom Activity: Learn about different bases and numerical ideas: Base 2, binary and connections to computer programming, how the Yoruba of Nigeria used base 20, and how the Mayans conceptualized the

number 0 before the first recording of it

Solicit student ways of thinking and processing.

- Verbal Example: How might you all go about this? What do you notice?
- Classroom Activity: Incorporate explorations, where students interact with mathematics in a way that allows them to “discover” or experience mathematics.

Reorganize your classroom teaching around concepts, and teach them more like a web rather than discrete sets of knowledge.

- Verbal Example: How does this connect to what you’ve learned in the past? How can you use that knowledge today?
- Classroom Activity: Learning webs that connect content

Start with more complex math problems and scaffold as necessary.

- Verbal Example: If we wanted to build a rocket, what are all the things we might need to know before we get started? Along the way, we decided that we want the rocket to reach the moon. What do we need to consider now?
- Classroom Activity: When solving equations, start with the most complex problem, generate ideas for how to solve it, and use the simpler equations as examples to support those ideas.

Offer a variety of ways to demonstrate thinking and knowledge.

- Verbal Example: Show your thinking with words, pictures, symbols.

Ask other questions that will demonstrate learning when it is not clear to you how students know the answer.

- Verbal Example: If you were working with a fellow mathematician who was absent this day, what might you tell them to help them learn it?

Learn about, engage with, and incorporate ethnomathematics.

- Verbal Example: Reflect on your day so far. What math have you already used today?
- Classroom Activity: Community walks to engage with slope.

Co-construct knowledge in the classroom.

- Verbal Example: Let’s get into partners and do a think pair-share. We will incorporate everyone’s ideas and try to synthesize them.
- Classroom Activity: Have students create mathematical definitions in their own words in groups, and bring the groups together to co-construct mathematical definitions as a class

Choose problems that have complex, competing, or multiple answers.

- Verbal Example: Come up with at least two answers that might solve this problem.
- Classroom Activity: Challenge standardized test questions by getting the “right” answer, but justify other answers by unpacking the assumptions that are made in the problem.
- Classroom Activity: Deconstructed Multiple Choice
 - given a set of multiple choice answers, students discuss why these answers may have been included (can also be used to highlight common mistakes).

Identify what is right about the thinking, and highlight the mistake in what is factually or procedurally accepted.

- Verbal Example: You recognized that you had to combine the constants 27 and 9, could you explain your thinking?
- Classroom Activity: Error Analysis worksheets that highlight what is the right idea behind the mistake.

Using thoughtful questioning to solicit mathematical thoughts rather than telling.

- Verbal Example: What would a mathematician who is confused ask about this question?
- Classroom Activity: After students demonstrate knowledge of a topic, have them play a game where they have to explain their topic to a fellow mathematician and a skeptic. Develop their own reflective questioning/explaining in all three roles.

Create multiple ways of participating that honor myriad ways of thinking and being.

- Verbal Example: For this section, feel free to work alone, in pairs, trios, or quads (let them choose).
- Classroom Activity: Community circles or storytelling circles, incorporating dance, music, song, call and response, and other cultural ways of communicating.

Climate Change

[Math Climate Change Companion Guide](#)

- S.ID.B.6a Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.

Climate Change Example: Students may use linear or exponential functions fitted to geoscience data to solve problems and analyze the results from global climate models to make an evidence-based forecast of the current rate of global climate change.

- F.IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Climate Change Example: Students may use function notation to determine the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline), m , where $c(m)$ is the number of molecules of carbon dioxide.

- F.IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function gives the number of person-hours it takes to assemble n engines in a

factory, then the positive integers would be an appropriate domain for the function.

Climate Change Example: Students may relate the domain of a function $c(m)$ representing the amount of carbon dioxide produced by burning m molecules of ethane (gasoline), to its graph in order to determine the appropriate domain for $c(m)$.

- F.IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Climate Change Example: Students may calculate the average rate of change of a function $c(m)$ presented symbolically or as a table, where $c(m)$ represents the amount of carbon dioxide produced by burning a given number of molecules of ethane (gasoline).

- A.CED.A.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

Climate Change Example: Students may create equations and/or inequalities to represent the economic impact of climate change.

- A.CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.

Climate Change Example: Students may represent constraints describing the economic impact of climate change by equations, inequalities, and/or by systems of inequalities, and interpret solutions as viable or nonviable options.

- A.CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law to highlight resistance R .

Climate Change Example: Students may rearrange formulas related to the economic impact of climate change to highlight a quantity of interest, using the same reasoning as in solving equations.

- N.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

Climate Change Example: Students may use units to guide the solution of multi-step problems about how variations in the flow of energy into and out of the Earth's systems result in climate change. Note: Changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.

- N.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

Climate Change Example: Students may define appropriate quantities for a descriptive model of how variations in the flow of energy into and out of Earth's systems result in climate change. Note: changes in climate are limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.

TECH.9.4.2.CI

Creativity and Innovation

TECH.9.4.2.CT

Critical Thinking and Problem-solving

Digital tools have a purpose.