

# Topic 01: Foundations of Geometry

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 1**  
Length: **6 weeks**  
Status: **Published**

## Standards

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### Math Standards

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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.G-CO.C.9	Prove theorems about lines and angles.
MA.G-CO.C.10	Prove theorems about triangles.
MA.G-CO.C.11	Prove theorems about parallelograms.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.A-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.G-GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

### Mathematical Practices

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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-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

### Life Literacies and Key Skills

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TECH.9.4.12.CI.1

Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

TECH.9.4.12.TL.1

Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

## Transfer Goals

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## Transfer Goals

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Topic 1 begins by focusing on the measurements and properties of line segments and angles. The rest of the topic introduces proofs. Students examine the nature of basic reasoning in both inductive and deductive forms, explore if-then statements, and then write their first proofs.

## Concepts

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## Essential Questions

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- 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 contradictions?

## Understandings

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- The sum of the lengths of the smaller parts of a segment is the length of the segment. The sum of the measures of the two smaller angles that form the larger angle is the measure of the larger angle.
- A construction is a geometric figures produced using only a straightedge and a compass. Constructions are useful tools for geometry.
- The midpoint formula is used to find the midpoint of a segment in the coordinate plane and the distance formula to find length. The midpoint formula can be adapted to partition a segment into any ratio of lengths.
- Inductive reasoning can be used to identify patterns, provide evidence for or disprove conjectures, and

make predictions.

- Many real world problem situations can be represented with a mathematical model but that model might not represent the real world situation exactly.
- In mathematics, conditional statements are expressed as if-then statements consisting of a hypothesis and a conclusion. Conditional statements can be evaluated using truth tables.
- Deductive reasoning is the process of using given statements or facts to reach a valid conclusion.
- Justify statements of a proof with definitions, postulates, theorems, and properties.
- Indirect reasoning assumes the statement is to be proved false, then shows that assumption leads to a contradiction.

## **Critical Knowledge and Skills**

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### **Knowledge**

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Students will know:

- collinear points
- line
- plane
- point
- postulate
- angle bisector
- construction
- perpendicular bisector
- midpoint
- conjecture
- counterexample
- inductive reasoning
- biconditional
- conditional
- contrapositive
- conditional
- contrapositive
- converse
- inverse
- negation
- truth table
- truth value
- deductive reasoning
- Law of Detachment
- Law of Syllogism
- proof
- theorem

- indirect proof

## **Skills**

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Students will be able to:

- use the Ruler and Segment Addition postulates
- use the protractor and the Angle Addition postulates
- identify congruent segments and congruent angles
- construct copies of segments and angles, perpendicular bisectors of segments, and bisectors of angles
- apply construction to solve problems
- use the midpoint formula to find the midpoint of a segment drawn on a coordinate plane
- use the distance formula to find the length of a segment drawn on the coordinate plane
- use inductive reasoning to identify patterns and make predictions based on data
- use inductive reasoning to provide evidence that conjectures are true or provide counterexamples to disprove them
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of their math models
- explain why the results from their mathematical models might not align exactly with the problem situation
- write conditional and biconditional statements
- find the contrapositive converse, and inverse of a conditional statement
- find truth values for conditional statements and complete truth tables
- use deductive reasoning to draw a valid conclusion based on a set of given facts
- use deductive reasoning to prove geometric theorems about the lines and angles
- understand and use indirect reasoning to prove or disprove propositions and theorems
- write indirect proofs

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

## **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Geometry

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- **Google Products**
  - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
  - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.
- **One to One Student's laptop**
  - All students within the West Deptford School District are given a computer, allowing for 21st

century learning to occur within every lesson/topic.

### • Additional Support Videos

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

## **Differentiated Instruction**

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### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded

reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ Within each lesson, special education students are given choice of topic and resources so that their materials are within their ability level and high-interest.
- ☐ All content will be modeled with examples and all essays are built on a step-by-step basis so modifications for assignments in small chunks are met.

All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

### **Interdisciplinary Connections**

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**ELA-Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.**

**SCIENCE -**

**SOCIAL STUDIES -**

**WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS - Students will learn how to construct a golden rectangle. They will decide how to use the golden rectangle in the design of a new tablet and digital screen.**

**APPLIED TECHNOLOGY -**

**BUSINESS EDUCATION -**

**GLOBAL AWARENESS -**

**PHYSICAL EDUCATION-Students will be presented with several mystery objects. They will be tasked**

with identifying each object (ie. a dart board) and using tools and techniques to determine the number of spokes on each object.

## **Learning Plan / Pacing Guide**

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### Geometry

#### **Week 1:**

- Distribution of codes, course introduction, textbook tutorial
- Readiness Assessment
- Introduce STEM Project (directly involves concepts from section 1.2)
- 1.1 Measuring Segments and Angles (2 of 3 days)

#### **Week 2:**

- 1.1 continued (2 days)
- 1.2 Basic Constructions (2 days)

#### **Week 3:**

- 1.3 Midpoint and Distance (2 days)
- Review
- Quiz 1.1-1.3

#### **Week 4:**

- 1.4 Inductive Reasoning (2 days)
- Mathematical Modeling: The Mystery Spokes
- 1.5 Conditional Statements (2 days)

#### **Week 5:**

- 1.6 Deductive Reasoning (2 days)
- Review
- Quiz 1.4-1.6

#### **Week 6:**

- 1.7 Writing Proofs (2 days)
- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

### Honors Geometry

#### **Week 1:**



- Distribution of codes, course introduction, textbook tutorial
- Introduce STEM Project
- 1.1 Measuring Segments and Angles (1 of 2 days)

#### **Week 2:**

- 1.1 continued (2 of 2 days)
- 1.2 Basic Constructions (2 days)
- 1.3 Midpoint and Distance (2 days)

#### **Week 3:**

- 1.3 Midpoint and Distance (2 days)
- Review
- Quiz 1.1-1.3

#### **Week 4:**

- 1.4 Inductive Reasoning (2 days)
- Mathematical Modeling: The Mystery Spokes
- 1.5 Conditional Statements (2 days)

#### **Week 5:**

- 1.6 Deductive Reasoning (2 days)
- Review
- Quiz 1.4-1.6

#### **Week 6:**

- 1.7 Writing Proofs (2 days)
- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

#### ICR Geometry

#### **Week 1:**

- - Distribution of codes, course introduction, textbook tutorial
  - Readiness Assessment
  - 1.1 Measuring Segments and Angles (1 of 3 days)

#### **Week 2:**

- - 1.1 continued (2 days)
  - 1-1 Quiz
  - 1.3 Midpoint and Distance (1 of 3 days)

### **Week 3:**

- - 1.3 Midpoint and Distance (5 days)

### **Week 4**

- - 1.7 Writing Proofs (3 of 4 days)
  - Benchmark Assessment

### Resource Center

### **Week 1:** (Skip 1.2 and 1.4-6)

- Distribution of codes, course introduction, textbook tutorial
- Readiness Assessment
- Introduce STEM Project
- 1.1 Measuring Segments and Angles (1 of 3 days)

### **Week 2:**

- 1.1 continued (2 days)
- 1.3 Midpoint (2 days)
- 1.3 Distance (1 of 2 days)

### **Week 3:**

- 1.3 Distance (2 of 2 days)
- Review (2 days)
- Quiz 1.1-1.3

### **Week 4 and 5**

- 1.7 Writing Proofs (2 days)
- Topic Review (3 days)
- Topic Assessment (2 days)
- Topic Performance Assessment (2 days)
- Complete STEM Project

# Topic 02: Parallel & Perpendicular Lines

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 1**  
Length: **4 weeks**  
Status: **Published**

## Standards

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### Math Standards

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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.G-CO.C.9	Prove theorems about lines and angles.
MA.G-CO.C.10	Prove theorems about triangles.
MA.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
MA.G-MG.A.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).
MA.G-GPE.B.5	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

### Mathematical Practices

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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-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

### Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.4	Participate in online strategy and planning sessions for course-based, school-based, or other project and determine the strategies that contribute to effective outcomes.
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

## Transfer Goals

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### Transfer Goals

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Topic 2 begins by focusing on the properties of parallel lines and the angle relationships formed when parallel lines are cut by a transversal. The rest of the topic examines how these angle relationships can help prove whether or not lines are parallel, the relationships between parallel lines and triangle angles, and the relationships between the slopes of parallel and perpendicular lines.

### Concepts

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### Essential Questions

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

### Understandings

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- When parallel lines are cut by a transversal, the special angle pairs that are formed are congruent, supplementary or both.
- Pairs of congruent or supplementary angles formed when two lines are cut by a transversal can be used to prove parallel lines.
- The sum of the measures of the interior angles of a triangle is 180, and the measure of an exterior angle of a triangle is equal to the sum of the measures of the remote interior angles.
- Two parallel lines have equal slopes. The slopes of perpendicular lines are negative multiplicative reciprocals of each other.
- Many real world situations can be represented with a mathematical model, but that model might not represent real-world situation exactly.

### Critical Knowledge and Skills

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## **Knowledge**

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Students will know:

- flow proof

## **Skills**

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Students will be able to:

- define parallel lines using the undefined terms point and line
- prove theorems about lines and angles
- use theorems to find the measures of angles formed by parallel lines and a transversal
- prove that two lines cut by a transversal are parallel using the converses of parallel line angle relationship theorems
- use properties of parallel lines and transversals to solve real-world and mathematical problems
- write and use flow proofs
- use lines constructed parallel to another line to solve problems and prove theorems
- use the sum of the angle measure in a triangle to solve problems
- show that two lines in the coordinate plane are parallel by comparing their slopes and use that information to solve problems
- show that two lines in the coordinate plane are perpendicular by comparing their slopes and use that information to solve problems
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of their math model
- explain why the results from their mathematical models might not align exactly with the problem situation

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets

- Reflections
- Performance Tasks

## **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Geometry

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- Google Products
  - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
  - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay

connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

## **Differentiated Instruction**

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### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**ELA-Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.**

**SCIENCE -**

**SOCIAL STUDIES -**

**WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS -**

**APPLIED TECHNOLOGY - Students will learn how builders incorporate parallel lines to provide stability and structure when constructing a roof. Students will analyze a situation involving paving roads with certain conditions. They will be tasked with determining whether pairs of lines are parallel, perpendicular or neither.**

**BUSINESS EDUCATION -**

**GLOBAL AWARENESS -**



## **Learning Plan / Pacing Guide**

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### **Geometry**

#### **Week 1:**

- Introduce STEM Project: Build a Roof
- 2.1 - Parallel Lines (2 days)
- 2.2 - Proving Parallel Lines (1 of 2 days)

#### **Week 2:**

- 2.2 continued
- Review
- Quiz 2.1-2.2
- 2.3 - Parallel Lines and Triangle Angle Sums (1 of 2 days)

#### **Week 3:**

- 2.3 continued
- 2.4 - Slopes of Parallel and Perpendicular Lines (2 days)
- Mathematical Modeling: Parallel Paving Company
- Topic Review

#### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

### **Honors Geometry**

#### **Week 1:**

- Introduce STEM Project: Build a Roof
- 2.1 - Parallel Lines (2 days)
- 2.2 - Proving Parallel Lines (1 of 2 days)

#### **Week 2:**

- 2.2 continued
- Review
- Quiz 2.1-2.2
- 2.3 - Parallel Lines and Triangle Angle Sums (1 of 2 days)

### **Week 3:**

- 2.3 continued
- 2.4 - Slopes of Parallel and Perpendicular Lines (2 days)
- Mathematical Modeling: Parallel Paving Company
- Topic Review

### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

## **ICR**

### **Week 1:**

- Introduce STEM Project: Build a Roof
- 2.1 - Parallel Lines (2 days)
- 2.2 - Proving Parallel Lines (1 of 2 days)

### **Week 2:**

- 2.2 continued
- Review
- Quiz 2.1-2.2
- 2.3 - Parallel Lines and Triangle Angle Sums (1 of 2 days)

### **Week 3:**

- 2.3 continued
- 2.4 - Slopes of Parallel and Perpendicular Lines (2 days)
- Mathematical Modeling: Parallel Paving Company (2 days)

#### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

### **Resource Center**

#### **Week 1:**

- Introduce STEM Project: Build a Roof
- 2.1 - Parallel Lines (2 days)
- 2.2 - Proving Parallel Lines (1 of 3 days)

#### **Week 2:**

- 2.2 continued (2 days)
- Review
- Quiz 2.1-2.2

#### **Week 3:**

- 2.3 - Parallel Lines and Triangle Angle Sums (2 days)
- 2.4 - Slopes of Parallel and Perpendicular Lines (2 days)
- Mathematical Modeling: Parallel Paving Company

#### **Week 4 and 5**

- Topic Review activities
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

# Topic 03: Transformations

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 2**  
Length: **4 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.G-CO.A.2	Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
MA.G-CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
MA.G-CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
MA.G-CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
MA.G-CO.B.6	Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

### Mathematical Practices

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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-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

### Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

## Transfer Goals

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## Transfer Goals

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Topic 3 begins by focusing on transformations, moving from the definition of rigid motion to the rigid transformations: reflections, translations, and rotations. The rest of the topic examines how transformations can be combined to create new images and complete proofs, such as the proof for demonstrating that a composition of two or more rigid motions is also a rigid motion.

## Concepts

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## Essential Questions

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- How are the properties of reflection used to transform a figure?
- What are the properties of a translation?
- What are the properties that identify a rotation?
- How can rigid motions be classified?
- How can you tell whether a figure is symmetric?

## Understandings

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- Reflections are rigid motions across a line of reflection. Students will create an image given a preimage and the line of reflection both on a coordinate plane and without the use of the coordinate plane.
- A translation is a rigid motion that move all of the points of the preimage the same distance in the same direction. A translation is the composition of two reflections.
- Rotation is a rigid motion described by its center of rotation and angle of rotation. Any rotation can be described by two reflections whose lines of reflection meet at the center of rotation at half the angle of rotation.
- Any composition of rigid motions can be represented by a combination of at least two of the following: a translation, reflection, rotation, or glide reflection.

- A figure that can be mapped onto itself using rigid motions is symmetric. Rotational symmetry uses rotation to map a figure onto itself, and reflectional symmetry uses reflection to map a figure onto itself
- Many real world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.

## **Critical Knowledge and Skills**

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### **Knowledge**

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Students will know:

- composition of rigid motion
- glide reflections
- point symmetry
- reflectional symmetry
- rigid motion
- rotational symmetry

### **Skills**

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Students will be able to:

- find a reflected image and write a rule for a reflection
- define reflection as a transformation across a line of reflection with given properties and perform reflection on and off a coordinate grid
- translate a figure and write a rule for translation
- find the image of a figure after a composition of rigid motions
- prove that a translation is a composition of two reflections
- rotate a figure and write a rule for a rotation
- prove that a rotation can be written as the composition of two reflections
- specify a sequence of transformations that will carry a given figure onto another
- use geometric descriptions of rigid motions to transform figures
- describe the rotations and/or reflections that carry a polygon onto itself
- predict the effect of a given rigid motion on a figure
- identify types of symmetry in a figure
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of their math models
- explain why the results from their mathematical models might not align exactly with the problem situation

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

### **School Summative Assessment Plan**

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- Unit Assessment

### **Primary Resources**

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enVision Geometry

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

### **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- **Google Products**

- Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
- GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

### **Differentiated Instruction**

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#### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.



### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**ELA-Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.**

**SCIENCE -**

**SOCIAL STUDIES -**

## **WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS -** Students will apply concepts of related transformational geometry. Students will analyze mathematical illusion created with geometric transformations. They will be tasked with predicting the outcome of a particular sequence of rigid motions.

**APPLIED TECHNOLOGY -** Students will use transformations to simulate an animation. Students will draw a figure of their choice on the coordinate plane. Then they draw the figure after each of the four transformations and write the symbolic representation for the transformations. Students "code" transformations to simulate motion in this project.

## **BUSINESS EDUCATION -**

## **GLOBAL AWARENESS -**

### **Learning Plan / Pacing Guide**

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#### **Geometry**

##### **Week 1:**

- Introduce STEM project: Create an Animation
- 3.1 - Reflections (2 days)
- 3.2 - Translations (2 days)

##### **Week 2:**

- 3.3 - Rotations (2 days)
- Review
- Quiz 3.1-3.3

##### **Week 3:**

- 3.4 - Classification of Rigid Motions (2 days)
- 3.5 - Symmetry (2 days)
- Mathematical Modeling: The Perplexing Polygon

##### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

#### **Honors Geoemtry**

##### **Week 1:**

- Introduce STEM project: Create an Animation

- 3.1 - Reflections (2 days)
- 3.2 - Translations (2 days)

### **Week 2:**

- 3.3 - Rotations (2 days)
- Review
- Quiz 3.1-3.3

### **Week 3:**

- 3.4 - Classification of Rigid Motions (2 days)
- 3.5 - Symmetry (2 days)
- Mathematical Modeling: The Perplexing Polygon

### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

### **ICR**

### **Week 1 and 2:**

- Introduce STEM project: Create an Animation
- 3.1 - Reflections (3 days)
- 3.2 - Translations (3 days)
- 3.3 - Rotations (3 days)

### **Week 3 and 4:**

- Review (2 days)
- Quiz 3.1-3.3
- 3.4 - Classification of Rigid Motions (3 days)
- 3.5 - Symmetry (2 days)
- Mathematical Modeling: The Perplexing Polygon (2 days)

### **Week 5:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

### **Resource Center**

### **Week 1 and 2:**

- Introduce STEM project: Create an Animation
- 3.1 - Reflections (3 days)
- 3.2 - Translations (3 days)
- 3.3 - Rotations (3 days)

### **Week 3 and 4:**

- Review (2 days)
- Quiz 3.1-3.3
- 3.4 - Classification of Rigid Motions (3 days)
- 3.5 - Symmetry (2 days)
- Mathematical Modeling: The Perplexing Polygon (2 days) \*\*might skip this unit, depending on timing\*\*

### **Week 5:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

# Topic 04: Triangle Congruence

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 2**  
Length: **4 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.G-CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
MA.G-CO.B.6	Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.
MA.G-CO.B.7	Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
MA.G-CO.B.8	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
MA.G-CO.C.10	Prove theorems about triangles.
MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
MA.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

### Mathematical Practices

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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-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

## Transfer Goals and Career Ready Practices

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### Transfer Goals

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Topic 4 focuses on congruence and transformations resulting in congruent figures. The lesson includes the definitions of congruence and congruence transformations and provides examples to help students determine if figures are congruent. The topic then explores various triangles and defines congruence theorems that prove triangles are congruent given congruent angles and sides of triangles.

### Concepts

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### Essential Questions

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- What is the relationship between rigid motions and congruence?
- How are the side lengths and angle measures related in isosceles triangles and 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 show that two overlapping triangles are congruent?

### Understandings

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- Figures that have the same size and shape are congruent. If a rigid motion or composition of rigid motions can map one figure onto another, then the figures are congruent.
- An isosceles triangle has congruent base angles and legs. The angle bisector of the vertex angle of an isosceles triangle is also the perpendicular bisector of the base. An equilateral triangle is also equiangular.
- Many real world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.

- If two sides and the included angle of one triangle are congruent to two sides and the included angle of another triangle then the triangles are congruent. If two triangles are congruent, then all corresponding angles and sides of the two triangles are congruent.
- Two triangles are congruent if two pairs of corresponding angles and the included sides are congruent. Two polygons are congruent if they can be divided into corresponding congruent triangular regions.
- Two triangles can be proven congruent without showing that all corresponding parts are congruent. Right triangles can be proven congruent using one pair of right angles a pair of hypotenuses and a pair of legs.
- When a figure includes triangles that overlap, sides and angles can be shown congruent using appropriate addition postulates. It is often helpful to sketch needed triangles separately in order to solve problems with overlapping triangles.
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## **Critical Knowledge and Skills**

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### **Knowledge**

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Students will know:

- congruence transformation
- congruent

### **Skills**

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Students will be able to:

- relate congruence to rigid motions
- demonstrate that two figures are congruent by using one or more rigid motions to map on onto another
- use properties of and theorems about isosceles and equilateral triangles to solve problems
- identify congruent triangles using properties of isosceles and equilateral triangles
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of their math models
- explain why the results from their mathematical might not align exactly with the problem situation
- prove triangles congruent by SAS and SSS criteria and use triangle congruence to solve problems
- understand that corresponding parts of congruent triangles are congruent and use CPCTC to prove theorems and solve problems
- prove that two triangles are congruent using ASA and AAS criteria and apply ASA to solve problems
- prove that when all corresponding sides and angles of two polygons are congruent, the polygons are congruent.
- prove and use Hypotenuse-Leg theorem
- use congruence criteria for triangles to solve problems to prove relationships in geometric figures

- apply congruence criteria to increasingly difficult problems involving overlapping triangles and multiple triangles
- prove triangles are congruent by identifying coresponding parts and using theorems

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

### **School Summative Assessment Plan**

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- Unit Assessment

### **Primary Resources**

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enVision Geometry

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

### **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices



- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- **Google Products**

- Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
- GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

### **Differentiated Instruction**

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#### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ Within each lesson, special education students are given choice of topic and resources so that their materials are within their ability level and high-interest.
- ☐ All content will be modeled with examples and all essays are built on a step-by-step basis so modifications for assignments in small chunks are met.

All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)

## **Interdisciplinary Connections**

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**ELA-Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.**

**SCIENCE - Students will learn how a truss adds stability to a bridge. The location of the bridge could be over a river or over a road.**

**SOCIAL STUDIES -**

**WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS - Students will explore and apply concepts related to congruent triangles. Students will analyze triangles drawn to certain specifications. They will be tasked with determining what it means for two triangles to be "the same" and whether all triangles meet the criteria are the same.**

**APPLIED TECHNOLOGY -**

**BUSINESS EDUCATION -**

**GLOBAL AWARENESS -**

## **Learning Plan / Pacing Guide**

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### **Geometry**

#### **Week 1:**

- Introduce STEM Project: Design a Bridge
- 4.1 - Congruence (2 days)
- 4.2 - Isosceles and Equilateral Triangles (2 days)

#### **Week 2:**

- Review 4.1-4.2
- Quiz 4.1-4.2
- Mathematical Modeling - Check it Out!
- 4.3 - Proving and Applying the SAS and SSS Congruence Criteria (2 days)

#### **Week 3:**

- 4.4 - Proving and Applying the ASA and AAS Congruence Criteria (2 days)
- 4.5 - Congruence in Right Triangles (2 days)
- Review 4.3-4.5

#### **Week 4:**

- Review 4.3-4.5
- Quiz 4.3-4.5
- 4.6 - Congruence in Overlapping Triangles (2 days)
- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

#### **Honors Geometry**

#### **Week 1:**

- Introduce STEM Project: Design a Bridge
- 4.1 - Congruence (2 days)
- 4.2 - Isosceles and Equilateral Triangles (2 days)

#### **Week 2:**

- Review 4.1-4.2
- Quiz 4.1-4.2
- Mathematical Modeling - Check it Out!
- 4.3 - Proving and Applying the SAS and SSS Congruence Criteria (2 days)

#### **Week 3:**

- 4.4 - Proving and Applying the ASA and AAS Congruence Criteria (2 days)
- 4.5 - Congruence in Right Triangles (2 days)
- Review 4.3-4.5

#### **Week 4:**

- Review 4.3-4.5
- Quiz 4.3-4.5
- 4.6 - Congruence in Overlapping Triangles (2 days)
- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

ICR

#### **Week 1:**

- Introduce STEM Project: Design a Bridge
- 4.1 - Congruence (2 days)
- 4.2 - Isosceles and Equilateral Triangles (2 days)

#### **Week 2:**

- Review 4.1-4.2

- Quiz 4.1-4.2
- Mathematical Modeling - Check it Out!

### **Week 3**

- 4.3 - Proving and Applying the SAS and SSS Congruence Criteria (2 days)
- 4.4 - Proving and Applying the ASA and AAS Congruence Criteria (2 days)
- 4.5 - Congruence in Right Triangles (day 1 of 2)

### **Week 4**

- 4.5 - Congruence in Right Triangles (2 of 2)
- Review 4.3-4.5
- Quiz 4.3-4.5
- Topic Review

### **Week 5**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

### Resource Center

#### **Week 1:**

- Introduce STEM Project: Design a Bridge \*\*optional if time allows\*\*
- 4.1 - Congruence (2 days)
- 4.2 - Isosceles and Equilateral Triangles (2 days)

#### **Week 2:**

- Review 4.1-4.2
- Quiz 4.1-4.2
- Mathematical Modeling - Check it Out!

### **Week 3**

- 4.3 - Proving and Applying the SAS and SSS Congruence Criteria (2 days)
- 4.4 - Proving and Applying the ASA and AAS Congruence Criteria (2 days)
- 4.5 - Congruence in Right Triangles (day 1 of 2)

### **Week 4**

- 4.5 - Congruence in Right Triangles (2 of 2)
- Review 4.3-4.5
- Quiz 4.3-4.5

- Topic Review

## **Week 5**

- Topic Review
- Topic Assessment
- Topic Performance Assessment \*\*if needed use Mathematical Modeling as Performance Assessment for this Unit\*\*
- Complete STEM project

# Topic 05: Relationships in Triangles

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 2**  
Length: **3 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.G-C.A.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
MA.G-CO.C.9	Prove theorems about lines and angles.
MA.G-CO.C.10	Prove theorems about triangles.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
MA.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
MA.A-REI.C.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
MA.G-GPE.B.5	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).
MA.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

### Mathematical Practices

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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-12.7	Look for and make use of structure.

### Life Literacies and Key Skills

---

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or

practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).

TECH.9.4.12.TL.1

Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).

## Transfer Goals

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### Transfer Goals

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Topic 5 begins by focusing on the concurrent points found in a triangle using perpendicular bisectors, angle bisectors, medians, and altitudes. The rest of the topic examines the relationships of the angle measures and side lengths within a triangle, as well as the angle measures and side lengths of two triangles.

## Concepts

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### Essential Questions

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- What is the relationship between a segment and the points on its perpendicular bisector? Between an angle and the points on its bisector?
- What are the properties of the perpendicular bisectors in a triangle? What are the properties of the angle bisectors in a triangle?
- What are the properties of the medians in a triangle? What are the properties of the altitudes in a triangle?
- When two triangles have two pairs of congruent sides, how are the third pair of sides and the pair of angles opposite the third pair of sides related?

### Understandings

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- The perpendicular bisector of a segment contains all the points that are equidistant from the endpoints of the segment, and an angle bisector contains all the points that are equidistant from the sides of the angle.
- The perpendicular bisectors of the sides of a triangle are concurrent at its circumcenter. The angle bisectors of a triangle are concurrent at its incenter.
- Many real world problems can be represented with a mathematical model, but the model might not represent the real world situation exactly.
- The medians of a triangle are concurrent at its centroid. The lines containing the altitudes of the triangles are concurrent at its orthocenter.
- The lengths of the sides of a triangle are related to the measures of the angles in a triangle. The sum of the lengths of two sides of a triangle must be greater than the length of a third side
- When two triangles have two pairs of congruent sides, the longer third side is opposite the larger third



angle and the shorter third side is opposite the shorter third angle.

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## **Critical Knowledge and Skills**

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### **Knowledge**

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Students will know:

- altitude
- centroid
- circumcenter
- circumscribed
- concurrent
- equidistant
- incenter
- inscribed
- median
- orthocenter
- point of concurrency

### **Skills**

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Students will be able to:

- prove Perpendicular Bisector Theorem, the Angle Bisector Theorem and their converses
- use the Perpendicular Bisector theorem to solve problems
- use the Angle Bisector theorem to solve problems
- prove that the point of the concurrency of the perpendicular bisectors of a triangle, called the circumcenter, is equidistant from the vertices
- prove that the point of the concurrency of the angle bisectors of a triangle called the incenter, is equidistant from the sides
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of their math models
- explain why the results from their mathematical models might align exactly with the problem situation
- identify special segments in triangles and understand theorems about them
- find and use the point of concurrency of the medians of a triangle to solve problems and prove relationships in triangles
- find the point of concurrency of the altitudes of a triangle
- prove that the side lengths of a triangle are related to the angle measures of the triangle

- use the angle measures of a triangle to compare the side lengths of the triangle
- use the Triangle Inequality Theorem to determine if 3 given side lengths will form a triangle and to find a range of possible side lengths for a third side given 2 lengths.
- prove the Hinge Theorem and use the Hinge Theorem to side lengths
- prove the Converse of the Hinge Theorem to compare angle measures

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

### **School Summative Assessment Plan**

---

- Unit Assessment

### **Primary Resources**

---

enVision Geometry

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### **Supplementary Resources**

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- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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#### **• Additional Support Videos**

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## **Differentiated Instruction**

---

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- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that

extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
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- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**ELA-Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.**

**SCIENCE - Students will explore centers of mass mathematically and experimentally.**

**SOCIAL STUDIES - Students will explore and apply concepts related to relationships within triangles and points of concurrency. Students will analyze a situation involving three towns that can be modeled by the vertices of a triangle. They will be tasked with determining an appropriate location between the three towns.**

**WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS -**

**APPLIED TECHNOLOGY -**

**BUSINESS EDUCATION -**

**GLOBAL AWARENESS -**

## **Learning Plan / Pacing Guide**

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**\*\*Likely only Honors will teach these sections\*\***

### **Week 1:**

- **\*\*Introduce STEM Project: Find the Center of Mass**
- **\*\*5.1 - Perpendicular and Angle Bisectors (2 days)**
- **\*\*5.2 - Bisectors in Triangles (2 days)**

### **Week 2:**

- **\*\*Mathematical Modeling - Making it Fair**
- **\*\*5.3 - Medians and Altitudes**
- **\*\*Review 5.1-5.3**
- **\*\*Quiz 5.1-5.3**

### **Week 3:**

- **5.4 - Inequalities in One Triangle (2 days)**
- **5.5 - Inequalities in Two Triangles (2 days)**
- **Quiz for CP and ICR**
- **\*\*Topic Review**
- **\*\*Topic Assessment**
- **\*\*Topic Performance Assessment**
- **\*\*Complete STEM project**

ICR

### **Week 1:**

- **5.4 - Inequalities in One Triangle (2 days)**

- 5.5 - Inequalities in Two Triangles (2 days)
- Quiz

RC

**Week 1:**

- 5.4 - Inequalities in One Triangle (2 days)
- Review
- Quiz

# Topic 06: Quadrilaterals & Other Polygons

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 4**  
Length: **4 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.G-C.A.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
MA.G-CO.C.11	Prove theorems about parallelograms.
MA.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

### Mathematical Practices

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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-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

### Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.IML.3	Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8).

### Transfer Goals

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## Transfer Goals

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Topic 6 begins by focusing on the interior and exterior angles of polygons. The rest of the topic focuses on quadrilaterals, examining properties of kites and trapezoids, and then the properties and conditions of parallelograms and special parallelograms.

## Concepts

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## Essential Questions

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- How does the number of sides in convex polygons relate to the sums of the measures of the exterior and interior angles?
- How are diagonals and angle measures related in kites and trapezoids?
- What are the relationships of the sides, the angles, and the diagonals of a parallelogram?
- Which properties determine whether a quadrilateral is a parallelogram?
- What properties of rhombuses, rectangles, and squares differentiate them from other parallelograms?
- Which properties of the diagonals of a parallelogram help you to classify a parallelogram?

## Understandings

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- The sum of the exterior angles of a polygon is 360, regardless of the number of sides. The sum of the interior angles of a polygon is  $180(n-2)$  where  $n$  is the number of sides.
- Many real world problems can be represented by a mathematical model, but that model might not represent the real world situation exactly.
- Diagonals of a kite are perpendicular and one diagonal bisects the other. In isosceles trapezoids, the diagonals are congruent. The length of the midsegment of a trapezoid is half the sum of the base lengths.
- In a parallelogram, consecutive angles are supplementary, opposite angles are congruent, opposite sides are congruent and the diagonals bisect each other.
- A quadrilateral with two pair of congruent opposite sides or one pair of congruent parallel sides or diagonals bisecting each other is a parallelogram. A quadrilateral with an angle supplementary to both its consecutive angles or two pairs of opposite congruent angles is a parallelogram.
- The diagonals of a rhombus are perpendicular, bisect each other, and bisect opposite angles. They form four congruent triangles. In a rectangle, the diagonals are congruent. Squares have properties of rhombuses and rectangles.
- A parallelogram with perpendicular diagonals or diagonals that bisect angles is a rhombus. A parallelogram with congruent diagonals is a rectangle. A parallelogram with perpendicular diagonals or congruent diagonals and a diagonal that bisects angles is a square.
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## Critical Knowledge and Skills

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### Knowledge

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Students will know:

- midsegment of a trapezoid

### Skills

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Students will be able to:

- show the sum of exterior angles of a polygon is 360 degrees and use that to solve problems
- show that the sum of the interior angles of a polygon is the product of 180 degrees and two less than the number of sides, and use that to solve problems
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of their math models
- explain why the results from their mathematical models might not align exactly with the problem situation
- use properties of the diagonal of kites to solve problems
- use properties of isosceles trapezoid to solve problems
- use the relationship between the lengths of the bases and the midsegment of a trapezoid to solve problems
- show that consecutive angles of a parallelogram are supplementary and opposite angles are congruent
- show that opposite sides of the parallelogram are congruent
- show that the diagonals of a parallelogram bisect each other
- demonstrate that a quadrilateral is a parallelogram based on its sides and diagonals
- demonstrate that a quadrilateral is a parallelogram based on its angles
- prove that the diagonals of rhombuses are perpendicular bisectors of each other and angle bisectors of the angles of the rhombus
- prove that the diagonals of a rectangle are congruent
- use properties of rhombus, rectangles and squares to solve problems
- identify rhombuses, rectangles and squares by the characteristics of diagonals of parallelograms

## Assessment and Resources

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## **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

## **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Geometry

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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## **Technology Integration**

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## ● Google Products

- Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
- GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

## ● One to One Student's laptop

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

## ● Additional Support Videos

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

## **Differentiated Instruction**

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### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.

- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

#### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

#### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

#### **Interdisciplinary Connections**

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**ELA-Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.**

**SCIENCE -**

**SOCIAL STUDIES -**

**WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS - Students will explore and apply concepts related to regular polygons. Students will be presented with several mystery objects (ie. honey comb). They will be tasked with identifying each object and determining the number of sides it has.**

**APPLIED TECHNOLOGY - Students will apply the properties of parallelograms to design a lift for a large and heavy vehicle.**

**BUSINESS EDUCATION -**

## **GLOBAL AWARENESS -**

### **Learning Plan / Pacing Guide**

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#### **Geometry**

##### **Week 1:**

- Introduce STEM Project: Design a Quadrilateral Lift
- 6.1 - The Polygon Angle-Sum Theorems (2 days)
- Mathematical Modeling: The Mystery Sides
- 6.2 - Kites and Trapezoids (1 of 2 days)

##### **Week 2:**

- 6.2 continued
- 6.3 - Properties of Parallelograms (2 days)
- Review 6.1-6.3
- Quiz 6.1-6.3

##### **Week 3:**

- 6.4 - Proving a Quadrilateral is a Parallelogram (2 days)
- 6.5 - Properties of Special Parallelograms (2 days)
- 6.6 - Conditions of Special Parallelograms (1 of 2 days)

##### **Week 4:**

- 6.6 continued
- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

#### **Honors Geometry**

##### **Week 1:**

- Introduce STEM Project: Design a Quadrilateral Lift
- 6.1 - The Polygon Angle-Sum Theorems (2 days)
- Mathematical Modeling: The Mystery Sides
- 6.2 - Kites and Trapezoids (1 of 2 days)

##### **Week 2:**

- 6.2 continued
- 6.3 - Properties of Parallelograms (2 days)
- Review 6.1-6.3

- Quiz 6.1-6.3

### **Week 3:**

- 6.4 - Proving a Quadrilateral is a Parallelogram (2 days)
- 6.5 - Properties of Special Parallelograms (2 days)
- 6.6 - Conditions of Special Parallelograms (1 of 2 days)

### **Week 4:**

- 6.6 continued
- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

ICR (This topic will be discussed at the end of the year)

### **Week 1:**

- Introduce STEM Project: Design a Quadrilateral Lift
- 6.1 - The Polygon Angle-Sum Theorems (2 days)
- Mathematical Modeling: The Mystery Sides (2 days)

### **Week 2:**

- 6.2 Kites and Trapezoids (2 days)
- 6.3 - Properties of Parallelograms (2 days)
- Review 6.1-6.3

### **Week 3 and 4**

- Quiz 6.1-6.3
- 6.5 - Properties of Special Parallelograms (2 days)
- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

RC ~ Only if time allows

# Topic 07: Similarity

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 3**  
Length: **3 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.G-C.A.1	Prove that all circles are similar.
MA.G-CO.A.2	Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
MA.G-CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
MA.G-CO.C.10	Prove theorems about triangles.
MA.G-SRT.A.2	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.
MA.G-SRT.A.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
MA.G-SRT.A.1a	A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.
MA.G-SRT.A.1b	The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
MA.G-SRT.B.4	Prove theorems about triangles.
MA.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

### Mathematical Practices

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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-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

## Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
TECH.9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.

## Transfer Goals

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### Transfer Goals

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Topic 7 begins with an examination of dilations and similarity transformations. These concepts are then applied to triangles; students examine the criteria for proving two triangles similar and analyze similarity in right triangles, including applications of the geometric mean. Finally, students consider proportions in triangles.

## Concepts

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## Essential Questions

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- How does a dilation affect the side lengths and angle measures of a figure?
- What makes a transformation a similarity transformation? What is the relationship between a preimage and the image resulting from a similarity transformation?
- How do similarity transformations determine the angle and side length conditions necessary for triangle similarity?
- In a right triangle, what is the relationship between the altitude to the hypotenuse, triangle similarity, and the geometric mean?
- When parallel lines intersect two transversals, what are the relationships among the lengths of the segments formed?

## Understandings

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- A dilation is a transformation that preserves angle measure but not length. The dilation of a figure is determined by the scale factor and the center of dilation. Every distance from the center of dilation and



every side length in a preimage are multiplied by the scale factor to find the corresponding distance and side length in the image.

- A similarity transformation is a dilation combined with one or more rigid motions. In order for two figures to be similar, there must be a similarity transformation that maps one figure onto the other. All circles are similar.
- Two triangles are similar if a composition of rigid motions and dilation will map one triangle onto the other. Two pairs of congruent angles, or three pairs of sides with lengths that are in the same proportion or two pairs of sides having congruent included angles with lengths that are in the same proportion, are sufficient to show that two triangles are similar.
- The length of the altitude to the hypotenuse of a right triangle is the geometric mean of the lengths of the two segments into which the altitude divides the hypotenuse. The length of a leg of a right triangle is the geometric mean of the length of the hypotenuse and the segment of the hypotenuse adjacent to the leg.
- Many real world problems can be represented by a mathematical model, but that model might not represent the real world situation exactly.
- A segment parallel to one side of a triangle divides the triangle into two similar triangles. If that segment connects the midpoints of two sides, the smaller triangle is in proportion 1:2 with the larger triangle. A segment that bisects an angle of a triangle divides the opposite side of the triangle into segments that are proportional to the adjacent sides.

## **Critical Knowledge and Skills**

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### **Knowledge**

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Students will know:

- center of dilation
- geometric mean
- similarity transformation

### **Skills**

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Students will be able to:

- dilate figures on and off the coordinate plane
- understand how distances and lengths in a dilation are related to scale factor and center of dilation
- understand that two figures are similar if there is a similarity transformation that maps one figure to the other
- identify a combination of rigid motions and dilation that maps one figure to a similar figure

- identify the coordinates of an image under a similarity transformation
- use dilations and rigid motions to prove triangles are similar
- prove and use the AA~, SSS~, and SAS~ theorems to prove triangles are similar
- use similarity of right triangles to solve problems
- use length relationships of the sides of right triangles and an altitude drawn to hypotenuse to solve problems
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of a mathematical model
- explain why the results from a mathematical model might not align exactly with the problem situation
- use the Side-Splitter Theorem and the Triangle Midsegment Theorem to find lengths of sides and segments of triangles
- use the Triangle-Angle Bisector Theorem to find lengths of sides and segments of triangles

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

### **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Geometry

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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### **Technology Integration and Differentiated Instruction**

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#### **Technology Integration**

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- **Google Products**

- Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
- GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

#### **Differentiated Instruction**

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##### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.**

**SCIENCE - Students use similarity to find the dimensions of an engine part, given the dimensions of a model of the part. The students will calculate key values related of the 3D printing of the part and**

**describe steps for its production.**

**SOCIAL STUDIES - Students will construct a model of a town in comparison to the mayor.**

**WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS -**

**APPLIED TECHNOLOGY -**

**BUSINESS EDUCATION -**

**GLOBAL AWARENESS -**

## **Learning Plan / Pacing Guide**

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### **Geometry**

#### **Week 1:**

- Introduce STEM Project: Design with a 3D Printer
- 7.1 - Dilations (2 days)
- 7.2 - Similarity Transformations (2 days)

#### **Week 2:**

- 7.3 - Proving Similar Triangles (2 days)
- \*\*7.4 - Similarity in Right Triangles (2 days)
- Mathematical Modeling: Make it Right
- 7.5 - Proportions in Triangles (2 days)

#### **Week 3:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

### **Honors Geometry**

#### **Week 1:**

- Introduce STEM Project: Design with a 3D Printer
- 7.1 - Dilations (2 days)
- 7.2 - Similarity Transformations (2 days)

#### **Week 2:**

- 7.3 - Proving Similar Triangles (2 days)
- \*\*7.4 - Similarity in Right Triangles (2 days)

- Mathematical Modeling: Make it Right
- 7.5 - Proportions in Triangles (2 days)

### **Week 3:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

ICR (Unit to be completed after Unit 5)

### **Week 1:**

- Introduce STEM Project: Design with a 3D Printer
- 7.1 - Dilations (2 days)
- 7.2 - Similarity Transformations (2 days)

### **Week 2:**

- 7.3 - Proving Similar Triangles (2 days)
- Mathematical Modeling: Make it Right
- 7.5 - Proportions in Triangles (2 days)

### **Week 3:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM project

RC (Depending on timing may not complete, teach Unit 8 Trig first)

### **Week 1:**

- Introduce STEM Project: Design with a 3D Printer
- 7.1 - Dilations (2 days)
- 7.2 - Similarity Transformations (day 1 of 3)

### **Week 2:**

- 7.2 Similarity Transformations (day 2 and 3)
- 7.3 - Proving Similar Triangles (2 days)
- Mathematical Modeling: Make it Right

### **Week 3 and 4**

- 7.5 Proportions in Triangles (2 days)
- Topic Review
- Topic Assessment
- Topic Performance Assessment

- Complete STEM project

# Topic 08: Right Triangles & Trigonometry

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 3**  
Length: **4 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.G-SRT.B.4	Prove theorems about triangles.
MA.G-SRT.C.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
MA.G-SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
MA.G-SRT.D.9	Derive the formula $A = (1/2)ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
MA.G-SRT.D.10	Prove the Laws of Sines and Cosines and use them to solve problems.
MA.G-SRT.D.11	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

### Mathematical Practices

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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-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

### Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).



## Transfer Goals

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### Transfer Goals

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Topic 8 begins by applying properties of similar right triangles to understand the Pythagorean Theorem, relationships in special right triangles, and trigonometric ratios. Students then extend their understanding of trigonometric ratios to include the Law of Sines and Law of Cosines. Finally, the students apply what they have learned to various contextual problems.

### Concepts

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### Essential Questions

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- How are similarity in right triangles and the Pythagorean Theorem related?
- How do trigonometric ratios relate angle measures to side lengths of right triangles?
- How can the Law of Sines be used to determine side lengths and angle measures in acute and obtuse triangles?
- How can the Law of Cosines be used to determine side lengths and angle measures of acute and obtuse triangles?
- How can trigonometry be used to solve real-world and mathematical problems?

### Understandings

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- The Pythagorean Theorem can be understood through the relationships between the similar triangles formed by the altitude to the hypotenuse. The length of the hypotenuse of a 45-45-90 triangle is  $\sqrt{2}$  times the leg length. The length of the hypotenuse of a 30-60-90 triangle is twice as long as the short leg and the longer leg is  $\sqrt{3}$  times the length of the shorter leg.
- For any two right triangles with given acute angle, the ratios of any two corresponding side lengths are equal. The ratio of the opposite side to the hypotenuse is the sine ratio, the ratio of the adjacent side to the hypotenuse is the cosine ratio and the ratio of the opposite side to the adjacent side is the tangent ratio.
- For any triangle, the ratio sine of an angle to the length of the opposite side is constant for all three pairs of angles and opposite sides. If two side lengths and the measure of the non-included angle, or two angle measures and a side length are known, all of the angle measures and side lengths of a triangle can be found.
- For any triangle, the square of the length of a side is the sum of the squares of the lengths of the other two sides, and the cosine of the angle between them. This relationship allows missing sides and angles to be found in the cases not covered by law of sines.

- Many real world problems can be represented by a mathematical model, but that model might not represent the real world situation exactly.
- The ratios of the corresponding sides of right triangles are constant for right triangles with given base angles and are related to the base angles. These relationships can be used to solve problems where side lengths, angle measures or areas of triangles are desired.

## **Critical Knowledge and Skills**

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### **Knowledge**

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Students will know:

- angle of depression
- angle of elevation
- cosine
- Law of Cosine
- Law of Sines
- Pythagorean triple
- sine
- tangent
- trigonometric ratios

### **Skills**

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Students will be able to:

- prove the Pythagorean Theorem using similar right triangles
- understand and apply the relationships between side lengths in 45-45-90 and 30-60-90 triangles
- define and calculate sine, cosine, and tangent ratios
- use trigonometric ratios to solve problems
- understand why the Law of Sines applies to any triangle
- use the Law of Sines to solve problems
- develop an understanding of the Law of Cosines to solve problems
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of a mathematical model
- explain why the results from a mathematical model might not align exactly with the problem situation
- Distinguish between angles of elevation and depression
- use trigonometric ratios and the Laws of Sines and Cosines to solve problems

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

### **School Summative Assessment Plan**

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- Unit Assessment

### **Primary Resources**

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enVision Geometry

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

### **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- **Google Products**

- Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
- GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

### **Differentiated Instruction**

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#### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.**

**SCIENCE - Students will use trigonometry and indirect measurement to find the height of an object that is too tall to measure directly. Students will analyze a situation in which they cannot measure the height of a tall tree directly. They will find a way to determine the height indirectly.**

**SOCIAL STUDIES -**

**WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS -**

**APPLIED TECHNOLOGY -**

**BUSINESS EDUCATION -**

**GLOBAL AWARENESS -**

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## **Learning Plan / Pacing Guide**

### **Geometry**

#### **Week 1:**

- Introduce STEM Project: Measure a Distance
- 8.1 - Right Triangles and the Pythagorean Theorem

#### **Week 2:**

- Review 8.1
- Quiz 8.1
- 8.2 - Trigonometric Ratios (3 days)

#### **Week 3:**

- \*\*8.3 - Law of Sines (1 day)
- \*\*8.4 - Law of Cosines (1 day)
- 8.5 - Problem Solving with Trigonometry (2 days)
- Topic Review

#### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

### **Honors Geometry**

#### **Week 1:**

- Introduce STEM Project: Measure a Distance
- 8.1 - Right Triangles and the Pythagorean Theorem

#### **Week 2:**

- Review 8.1
- Quiz 8.1
- 8.2 - Trigonometric Ratios (3 days)

### **Week 3:**

- 8.3 - Law of Sines (1 day)
- 8.4 - Law of Cosines (1 day)
- 8.5 - Problem Solving with Trigonometry (2 days)
- Topic Review

### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

### ICR

### **Week 1:**

- Introduce STEM Project: Measure a Distance
- 8.1 - Right Triangles and the Pythagorean Theorem

### **Week 2:**

- Review 8.1
- Quiz 8.1
- 8.2 - Trigonometric Ratios (3 days)

### **Week 3:**

- 8.5 - Problem Solving with Trigonometry (3 days)
- Topic Review (2 Days)

### **Week 4:**

- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

### Resource Center

### **Week 1:**

- Introduce STEM Project: Measure a Distance (Optional)
- 8.1 - Right Triangles and the Pythagorean Theorem (5 Days)

### **Week 2:**

- Review 8.1

- Quiz 8.1
- 8.2 - Trigonometric Ratios (3 days)

**Week 3:**

- 8.5 - Problem Solving with Trigonometry (4 days)
- Topic Review (1 of 2 Days)

**Week 4:**

- Topic Review (2 of 2)
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project



# Topic 09: Coordinate Geometry

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 4**  
Length: **2 weeks**  
Status: **Published**

## Standards

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### Math Standards

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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.G-CO.C.10	Prove theorems about triangles.
MA.G-GPE.A.1	Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
MA.G-GPE.A.2	Derive the equation of a parabola given a focus and directrix.
MA.G-GPE.B.4	Use coordinates to prove simple geometric theorems algebraically.
MA.G-GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
MA.G-GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

### Mathematical Practices

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MA.K-12.1	Make sense of problems and persevere in solving them.
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-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

### Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
TECH.9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.

## Transfer Goals

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### Transfer Goals

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Topic 9 examines several aspects of coordinate geometry. It begins by analyzing figures on the coordinate plane using slope, midpoint, and distance. Next, students examine coordinate proofs, using coordinate geometry to prove properties of figures. Finally, circles and parabolas on the coordinate plane are considered. Students develop equations of circles and parabolas and use them to solve problems.

### Concepts

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### Essential Questions

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- How are properties of geometric figures represented in the coordinate plane?
- How can geometric relationships be proven algebraically in the coordinate plane?
- How is the equation of a circle determined in the coordinate plane?
- How does the geometric description of a parabola relate to its equation?

### Understandings

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- Algebra is used to determine properties of geometric figures drawn on the coordinate plane. Slopes can be used to determine whether segments are parallel or perpendicular, the Distance Formula can be used to find the lengths of segments, and the Midpoint Formula can be used to bisect segments.
- Many real-world situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- Proofs using coordinate geometry require planning by determining the properties to be shown with algebra, drawing a labeled diagram on the coordinate plane, and calculating the values needed to show the desired relationships.
- The equation of a circle in the coordinate plane is given by  $(x-h)^2 + (y-k)^2 = r^2$ , where  $(h, k)$  is the center of the circle and  $r$  is the radius.
- An equation of a parabola in the coordinate plane with the vertex at the origin is given by  $y = 1/(4p) * x^2$ , where  $p$  is the distance between the focus and vertex. If the vertex is the point  $(h, k)$ , an equation of the parabola is given by  $y-k = 1/(4p) * (x-h)^2$ .

## **Critical Knowledge and Skills**

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### **Knowledge**

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Students will know:

- directrix
- focus
- parabola

### **Skills**

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Students will be able to:

- use coordinate geometry to classify triangles and quadrilateral on the coordinate plane
- solve problems involving triangles and polygons on the coordinate plane
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of a mathematical model
- explain why the results from mathematical model might not align exactly with the problem situation
- plan a method of proof using coordinate geometry
- prove theorems using algebra and the coordinate plane
- write the equation for a circle given the graph of the circle or given center and radius of the circle
- graph a circle from its equation
- explain the relationship between a focus and directrix and the corresponding parabola
- write equations for parabolas given the focus and directrix

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

## **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Geometry

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

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- Google Products
  - Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
  - GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

- **One to One Student's laptop**

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

## **Differentiated Instruction**

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### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate

differentiated practice based on student performance.

- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**ELA - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.**

**SCIENCE - Rays from the sun that strike a parabolic reflector parallel to the axis of symmetry are directed to the focus of the reflector, heating it. Students will use this principle to design a parabolic solar reflector and describe its properties and purpose.**

**SOCIAL STUDIES -**

**WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS - Students will look at lengths of a segment and make a conjecture about its midpoint. The students will test their answers by drawing a pair of points and place a midpoint between them.**

**APPLIED TECHNOLOGY -**

**BUSINESS EDUCATION -**

**GLOBAL AWARENESS -**

**\*\*If time allows, teach these three sections AFTER Topic 6. If less time, only teach 9.3.**

## **Geometry**

### **Week 1:**

- 9.1 - Polygons in the Coordinate Plane (2 days)
- Mathematical Modeling: You Be the Judge
- 9.2 - Proofs Using Coordinate Geometry (2 days)

### **Week 2:**

- 9.3 - Circles in the Coordinate Plane (2 days)
- Topic Review
- Topic Assessment
- Topic Performance Assessment

## **Honors Geometry**

### **Week 1:**

- 9.1 - Polygons in the Coordinate Plane (2 days)
- Mathematical Modeling: You Be the Judge
- 9.2 - Proofs Using Coordinate Geometry (2 days)

### **Week 2:**

- 9.3 - Circles in the Coordinate Plane (2 days)
- Topic Review
- Topic Assessment
- Topic Performance Assessment

## ICR

### **Week 1:**

- 9.3 - Circles in the Coordinate Plane (2 days)
- Topic Review
- Topic Quiz

## Resource Center

### **Week 1:**

- 9.3 - Circles in the Coordinate Plane (4 days)
- Topic Quiz





# Topic 10: Circles

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 4**  
Length: **4 weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.G-C.A.2	Identify and describe relationships among inscribed angles, radii, and chords.
MA.G-C.A.4	Construct a tangent line from a point outside a given circle to the circle.
MA.G-C.B.5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
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.G-CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

### Mathematical Practices

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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-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

### Life Literacies and Key Skills

---

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
TECH.9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.

### Transfer Goals

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## Transfer Goals

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Topic 10 begins with an examination of arc length, sector area, and segment area, and an introduction to radians as a unit of angle measure. Students then examine properties of tangents, chords, and inscribed angles. Finally, students learn about the properties of angles, arcs, and segment lengths that are formed when two lines intersect inside or outside a circle.

## Concepts

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## Essential Questions

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- How are arc length and sector area related to circumference and area of a circle?
- How is a tangent line related to the radius of a circle at the point of tangency?
- How are chords related to their central angles and intercepted arcs?
- How is the measure of an inscribed angle related to its intercepted arc?
- How are the measures of angles, arcs, and segments formed by intersecting secant lines related?

## Understandings

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- Arcs are classified as minor arcs or major arcs depending on whether they are smaller or larger than a semicircle. The length of an arc is a portion of the circumference proportional to the corresponding central angle. The area of a sector of a circle is a portion of the area of the circle proportional to the central angle. The area of a segment of a circle is the area of the corresponding sector minus the area of the corresponding triangle.
- A line that is tangent to a circle intersects the circle at exactly one point and is perpendicular to the radius to that point. If two segments are tangent to the same circle and have a common endpoint exterior to the circle, the segments are congruent.
- Many real-world situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- In a circle or congruent circles, two chords are congruent if the corresponding central angles are congruent or if the chords intercept congruent arcs. The perpendicular bisector of a chord is a diameter of the circle.
- In a circle, the measure of an inscribed angle is one-half of the measure of its intercepted arc. In a circle, the measure of an angle formed by a chord and a tangent to the circle is one-half of the measure of its intercepted arc.
- When two secants intersect inside a circle, the measure of the angle formed is half the sum of the intercepted arcs. When secants or tangents intersect outside a circle, the measure of the angle formed is half the difference of the intercepted arcs. When secants or tangents intersect inside or outside a circle, the product of the distances from the point of intersection to the points on the circle is the same for

both lines.

## Critical Knowledge and Skills

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### Knowledge

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Students will know:

- arc length
- central angle
- chord
- inscribed angle
- intercepted arc
- major arc
- minor arc
- point of tangency
- radian
- secant
- sector of a circle
- segment of a circle
- tangent of a circle

### Skills

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Students will be able to:

- calculate the length of an arc when the central angle is given in degrees or radians
- calculate the area of sectors and segments of circles
- identify lines that are tangent to a circle using angle measures and segment lengths
- solve problems involving tangent lines
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of a mathematical model
- explain why the results from a mathematical model might not align exactly with the problem situation
- prove and apply relationships between chords, arcs, and central angles
- find lengths of chords given distance from the center of the circle and use this information to solve problems
- identify and apply relationships between the measures of inscribed angles, arc, and central angles
- identify and apply the relationships between an angle formed by a chord and a tangent to its intercepted arc
- recognize and apply angle relationships formed by secants and tangents intersecting inside and outside a

circle

- recognize and apply segment length relationships formed by secants and tangents intersecting inside and outside a circle

## **Assessment and Resources**

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### **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

### **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

---

enVision Geometry

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## **Supplementary Resources**

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- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices

- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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### **Technology Integration**

---

- **Google Products**

- Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
- GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

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- **Additional Support Videos**

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

### **Differentiated Instruction**

---

#### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.
- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
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### **Special Education Students (N.J.A.C.6A:8-3.1)**

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- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

### **Interdisciplinary Connections**

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**ELA** - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

**SCIENCE** - Students will analyze a two-dimensional representation of two cylindrical space "cities" and then draw and analyze a group of three space cities of their own design. Students will analyze a

**situation in which two satellites orbit Earth.**

**SOCIAL STUDIES -**

**WORLD LANGUAGES -**

**VISUAL/PERFORMING ARTS -**

**APPLIED TECHNOLOGY -**

**BUSINESS EDUCATION -**

**GLOBAL AWARENESS -**

## **Learning Plan / Pacing Guide**

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### **Geometry**

#### **Week 1:**

- Introduce STEM Project: Design Space Cities
- 10.1 - Arcs and Sectors (2 days)
- 10.2 - Lines Tangent to a Circle

#### **Week 2:**

- Mathematical Modeling: Earth Watch
- 10.3 - Chords (2 days)
- Review 10.1-10.3
- Quiz 10.1-10.3

#### **Week 3:**

- 10.4 - Inscribed Angles (2 days)
- 10.5 - Secant Lines and Segments

#### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

### **Honors Geometry**

#### **Week 1:**

- Introduce STEM Project: Design Space Cities

- 10.1 - Arcs and Sectors (2 days)
- 10.2 - Lines Tangent to a Circle

### **Week 2:**

- Mathematical Modeling: Earth Watch
- 10.3 - Chords (2 days)
- Review 10.1-10.3
- Quiz 10.1-10.3

### **Week 3:**

- 10.4 - Inscribed Angles (2 days)
- 10.5 - Secant Lines and Segments

### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment
- Complete STEM Project

ICR

### **Week 1:**

- 10.1 - Arcs and Sectors (2 days)
- 10.2 - Lines Tangent to a Circle (2 Days)

### **Week 2:**

- 10.3 - Chords (2 days)
- Review 10.1-10.2
- Quiz 10.1-10.2

### **Week 3:**

- 10.4 - Inscribed Angles (2 days)
- 10.5 - Secant Lines and Segments (2 Days)

### **Week 4:**

- Topic Review
- Topic Assessment
- Topic Performance Assessment

Resource Center

### **Week 1:**

- 10.1 - Arcs and Sectors (3 days)
- 10.2 - Lines Tangent to a Circle (1 of 3 Days)



**Week 2:**

- 10.2 - Lines and Tangent to a Circle (Day 2 and 3)
- 10.3 - Chords (3 days)

**Week 3:**

- Review 10.1-10.2
- Quiz 10.1-10.2
- 10.4 - Inscribed Angles (2 days)

**Week 4:**

- Topic Review
- Topic Assessment

# Topic 11: Two- and Three-Dimensional Models

Content Area: **Math**  
Course(s): **GEOMETRY**  
Time Period: **Marking Period 1**  
Length: **weeks**  
Status: **Published**

## Standards

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### Math Standards

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MA.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
MA.G-MG.A.2	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).
MA.G-GMD.A.1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.
MA.G-GMD.A.2	Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.
MA.G-GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.
MA.G-GMD.B.4	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

### Mathematical Practices

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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-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

### Life Literacies and Key Skills

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TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

TECH.9.4.12.TL.1	Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.).
TECH.9.4.12.TL.3	Analyze the effectiveness of the process and quality of collaborative environments.

## Transfer Goals

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## Transfer Goals

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Topic 11 opens by considering the relationship between the numbers of faces, vertices, and edges in polyhedrons, examining cross sections, and determining the three-dimensional figure formed by rotating a two-dimensional figure. Students then consider the volume of oblique solids by comparing the cross sections of oblique solids to corresponding right solids. Throughout the topic, students apply the volume formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems.

## Concepts

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## Essential Questions

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- How are three-dimensional figures and polygons related?
- How does the volume of a prism or cylinder relate to a cross section parallel to its base?
- How are the formulas for volume of a pyramid and volume of a cone alike?
- How does the volume of a sphere relate to the volumes of other solids?

## Understandings

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- The sum of the number of faces and vertices of a polyhedron equals two more than the number of edges. The cross section of a plane and a convex polyhedron is a polygon. A polygon rotated about an axis yields a three-dimensional figure with circular cross sections.
- Cavalieri's Principle states that two figures with the same height and the same cross-sectional area at every level have the same volume. Cavalieri's Principle can be used to calculate the area of oblique prisms and cylinders.
- Many real-world situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.
- Cones and pyramids with the same height and the same area at every cross section have equal volume. The volume of a cone or pyramid can be found using the formula  $V = \frac{1}{3}Bh$ , where  $B$  is the area of the base and  $h$  is the height.
- Apply Cavalieri's Principle to show that the volume of a hemisphere is equal to the volume of a cylinder of equal diameter and height minus the volume of a cone of equal diameter and height. Find

the volumes of objects composed of two or more solids by decomposing the solid into its component parts.

## **Critical Knowledge and Skills**

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### **Knowledge**

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Students will know:

- Cavalieri's Principle
- hemisphere
- oblique cylinder
- oblique prism

### **Skills**

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Students will be able to:

- use Euler's Formula to calculate the number of vertices, faces, and edges in polyhedron
- describe cross sections of polyhedrons
- describe rotations of polygons about an axis
- understand how the volume formulas for prisms and cylinders apply to oblique prisms and cylinders
- model three-dimensional figures as cylinders and prisms to solve problems
- use mathematical modeling to represent a problem situation and to propose a solution
- test and verify the appropriateness of a mathematical model
- explain why the results from a mathematical model might not align exactly with the problem situation
- understand how the volume formulas for pyramids and cones apply to oblique pyramids and cones
- model three-dimensional figures as pyramids and cones to solve problems
- use Cavalieri's Principle to show how the volume of a hemisphere is related to the volume of a cone and a cylinder
- calculate volumes and surface areas of spheres and composite figures

## **Assessment and Resources**

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## **School Formative Assessment Plan (Other Evidence)**

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- Homework
- Quizzes
- Exit Tickets
- Reflections
- Performance Tasks

## **School Summative Assessment Plan**

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- Unit Assessment

## **Primary Resources**

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enVision Geometry

Pearson Education 2018 - [www.pearsonrealize.com](http://www.pearsonrealize.com)

## **Supplementary Resources**

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- IXL
- Khan Academy
- Desmos
- Kahoot
- Quizlet
- Kutasoftware
- Fostering Math Practices
- Making Number Talks Matter by Cathy Humphreys & Ruth Parker

## **Technology Integration and Differentiated Instruction**

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## **Technology Integration**

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## ● Google Products

- Google Classroom - Used for daily interactions with the students covering a vast majority of different educational resources (Daily Notes, Exit Tickets, Classroom Polls, Quick Checks, Additional Resources/ Support, Homework, etc.)
- GAFE (Google Apps For Education) - Using various programs connected with Google to collaborate within the district, co-teachers, grade level partner teacher, and with students to stay connected with the content that is covered within the topic. Used to collect data in real time and see results upon completion of the assignments to allow for 21st century learning.

## ● One to One Student's laptop

- All students within the West Deptford School District are given a computer, allowing for 21st century learning to occur within every lesson/topic.

## ● Additional Support Videos

The videos below are just examples of videos that can be used to support each of the Lessons within this Topic. There are more additional videos provided for each and can be assigned from the Pearson enVisions 2.0 online textbook from the teachers' login.

## **Differentiated Instruction**

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### **Gifted Students (N.J.A.C.6A:8-3.1)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Enrichment assignment which presents engaging problems and activities that extend the lesson concepts.

### **English Language Learners (N.J.A.C.6A:15)**

- ☐ When discussing different ways of solving problems, focus on keywords and phrases. ELL Students might also benefit by using concrete objects to demonstrate different concepts.
- ☐ Create place cards or simple signs for students using the vocabulary words. They can use the signs as a reference throughout the lesson.
- ☐ Work with ELL Teacher to allow for all assignments to be completed with extra time.

- ☐ Pair ELL students with a student who is fluent in English.
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.

#### **At-Risk Students (N.J.A.C.6A:8-4.3c)**

- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

#### **Special Education Students (N.J.A.C.6A:8-3.1)**

- ☐ All other IEP modifications will be honored (ie. hard copies of notes, directions restated, etc.)
- ☐ Students may complete Mathematical Literacy and Vocabulary assignment which helps students develop and reinforce understanding of key terms and concepts.
- ☐ Students will complete the Online Lesson Quiz and will be automatically assigned appropriate differentiated practice based on student performance.
- ☐ Students may complete Reteach to Build Understanding assignment which provides scaffolded reteaching for the key lesson concepts.

#### **Interdisciplinary Connections**

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**ELA** - Students will apply reasoning skills to justify statements. Students will justify statements through oral and written communication.

**SCIENCE** -

**SOCIAL STUDIES** -

**WORLD LANGUAGES** -

**VISUAL/PERFORMING ARTS** -

**APPLIED TECHNOLOGY** - Students will design a rigid package for a product. They will draw two- and three-dimensional representations of their package and build a prototype.

**BUSINESS EDUCATION** - Students will determine the best packaging option for candles by determining its surface area for a constant volume.

## GLOBAL AWARENESS -

### **Learning Plan / Pacing Guide**

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*IF THERE IS TIME, take one day for each section...*

#### **Geometry**

##### **Week 1:**

- Introduce STEM Project: Design a Rigid Package
- 11.1 - Three-Dimensional Figures and Cross-Sections
- 11.2 - Volumes of Prisms and Cylinders
- Mathematical Modeling: Box 'Em Up

##### **Week 2:**

- 11.3 - Pyramids and Cones
- 11.4 - Spheres
- Topic Review
- Topic Assessment

#### **Honors Geometry**

##### **Week 1:**

- Introduce STEM Project: Design a Rigid Package
- 11.1 - Three-Dimensional Figures and Cross-Sections
- 11.2 - Volumes of Prisms and Cylinders
- Mathematical Modeling: Box 'Em Up

##### **Week 2:**

- 11.3 - Pyramids and Cones
- 11.4 - Spheres
- Topic Review
- Topic Assessment

***\*\*ICR and Resource Center will not do this unit\*\****