Orange Public Schools

Office of Curriculum & Instruction

2019-2020 Mathematics Curriculum Guide

Geometry

Unit 3: Similarity and Congruent Triangles

January 31, 2020 –April 9, 2020

Board Approved: 1.14.2020

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Contents

Curriculum Map

A STORY OF UNITS (Yearlong Pacing Guide)				
Marking Period	MP 1 (9/9/19 – 11/13/19)	MP 2 (11/14/19- 1/30/20)	MP 3 (1/31/20-4/9/20)	MP 4 (4/10-20-6/22/20)
Unit Topic	Geometric Transformation	Reasoning with Angles & Lines	Similar & Congruent Triangles	Right Triangle Relationships and Trigonometry
Description	Using inductive reasoning and conjecture to performance rigid transformations for coordinate geometry.	Using deductive reasoning, logic statement and proof to understand angle relationships for parallel lines with transversals	Using dilation to define similarity of geometric figures and use the properties of similarity to solve problems	Using Pythagorean Theorem and the distance formula to understand the trig. ratios and use trig. ratios to solve problems

Unit Overview

Unit 3: Similarity and Congruent Triangles
Overview
This course uses Agile Mind as its primary resource, which can be accessed at the following URL: ➢ www.orange.agilemind.com Each unit consists of 4-6 topics. Within each topic, there are "Exploring" lessons with accompanying activity sheets, practice, and assessments. The curriculum guide provides an analysis of each topic, detailing the standards, objectives, skills, and concepts to be covered. In addition, it provides suggestions for pacing, sequence, and emphasis of the content.
Essential Questions
➢ Where we can see dilation in nature? ➢ How can we use the concept of similarity in our life? ➢ What are some conjectures for properties of triangles? How can we prove these conjectures to be true for all cases? ➢ How do you know the two figures are congruent or similar? ➢ How can I define and differentiate among transformations (Translation, Rotation, Reflection) in terms of essential concepts? ➢ What are the different points of concurrency in a triangle? ➢ How can I use congruence and similarity to prove relationships between figures resulting from transformations?
Enduring Understandings
➢ The base angles of an isosceles triangle are congruent. ➢ Two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent. ➢ Corresponding parts of congruent triangles are congruent. ➢ By proving two triangles congruent, many other geometric relationships can be proved and problems can be solved. ➢ Rigid transformations (motion) preserve a triangle's size and shape, therefore the image of triangles undergoing a series of rigid transformation will be congruent to its preimage ➢ Using ratios and proportions between two polygons, you can determine if the polygons ae similar
Common Core State Standards
1) G.CO.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. 2) G.CO.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. 3) G.CO.8: Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. 4) G.CO.9: Prove theorems about lines and angles. Theorems include: ~~vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding~~

~~angles are congruent;~~ points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

5) G.CO.10: Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; ~~the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length;~~ the medians of a triangle meet at a point.
6) G.SRT.1: Verify experimentally the properties of dilations given by a center and a scale factor:
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.
1b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
7) G.SRT.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
8) G.SRT.3: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
9) G-SRT.4: Prove theorems about triangles. *Theorems include: ~~a line parallel to one side of a triangle divides the other two proportionally, and conversely;~~ the Pythagorean Theorem proved using triangle similarity.*
10) G-SRT.5: Use ~~congruence and~~ similarity criteria for triangles to solve problems ~~and to prove relationships in geometric figures.~~
11) G-SRT.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.
12) G-SRT.8: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
13) G-GPE.6: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
14) G-GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*

Major Content
Supporting Content
Additional Content
~~Parts of standard not contained in this unit~~

21st Century Career Ready Practice

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Overview			
Topic	Name	NJSLS	Suggesting Pacing
7	Properties of a Triangle	G.CO.8 G.CO.10	5 Periods
12	Dilations and Similarity	G.CO.2 G.SRT.1 G.SRT.2 G.SRT.3 G.SRT.5	8 Periods
13	Applications of Similarity	G.CO.10 G.SRT.4 G.SRT.5	5 Periods
9	Congruent Triangle Postulates	G.CO.6 G.CO.7 G.CO.8 G.SRT.5	6 Periods
10	Using Congruent Triangles	G.CO.7 G.CO.10 G.ST.5	4 Periods

Summary:

28 days on new content (5 topics)
2 task days
1 review days
1 test day
3-4 NWEA days
2 benchmark assessment days

37-38 days in Unit 3

Note: Geometry Period (45 minutes per day)

Pacing Guide

Calendar:

Please create a pacing calendar for your classes based on the scopes and sequence (page 7) in this unit plan.

February 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat

February 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat

March 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat

March 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat

April 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat

April 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat

Student Learning Material

Agile Mind Geometry: https://orange.agilemind.com/LMS/lmswrapper/LMS.html

Drawing on more than twenty-five hundred years of mathematical work, Geometry introduces the tools central to the study of space and spatial relationships. Students began their study of geometric concepts in elementary and middle school mathematics. In middle school, they studied area, surface area, and volume and informally investigated lines, angles, and triangles. Students in middle school also explored transformations, including translations, reflections, rotations, and dilations. The Charles A. Dana Center and Agile Mind have intentionally designed this Geometry course to

begin with developing the tools of geometry, including transformations, proof, and constructions. These tools are used throughout the course as students formalize geometric concepts studied in earlier courses and extend those ideas to new concepts presented in the high school standards.

Once students have some tools with which to explore geometry, they begin to formalize geometric relationships involving angles, lines, triangles, quadrilaterals, and circles. Respecting a deeply rooted tradition, Geometry provides for students a first introduction to formal mathematical reasoning, logic, and proof, in which they are introduced to what constitute the standards of evidence in modern mathematics. Students spend time creating viable arguments around triangle congruence and similarity, using transformations as the key underlying definition of congruence and similarity.

Their study of triangles includes trigonometric ratios and right triangle relationships. Students create arguments and solve problems with shapes represented both on and off the coordinate grid. Coordinate geometry provides a connection and reinforcement to ideas studied in Algebra I. Students extend their understanding of plane geometry to model the world they live in using three-dimensional shapes. Extending their understanding of area and volume from middle school, students are able to solve geometric modeling problems and analyze characteristics of three-dimensional shapes, including plane sections and solids of revolution. Throughout the course, students focus on developing logical arguments and using geometry to model their world

There is a focus throughout the course on the Mathematical Practice Standards. These practices should become the natural way in which students come to understand and do mathematics. While—depending on the content to be understood or on the problem to be solved—any practice might be brought to bear, some practices may prove more useful than others. In a high school geometry course, communication, reasoning, and justification are particularly important, as are modeling, the strategic use of appropriate tools, and precision of language.

Modifications	
Special Education/ 504:	**English Language Learners:**
-Adhere to all modifications and health concerns stated in each IEP. -Give students a MENU options, allowing students to pick	- Use manipulatives to promote conceptual understanding and enhance vocabulary usage - Provide graphic representations, gestures, drawings,

assignments from different levels based on difficulty. -Accommodate Instructional Strategies: reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time -Allow students to demonstrate understanding of a problem by drawing the picture of the answer and then explaining the reasoning orally and/or writing , such as Read-Draw-Write -Provide breaks between tasks, use positive reinforcement, use proximity -Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum by using manipulatives -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 17-18) -Strategies for Students with 504 Plans	equations, realia, and pictures during all segments of instruction - During ALEKS lessons, click on "Español" to hear specific words in Spanish - Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information - Use sentence frames and questioning strategies so that students will explain their thinking/ process of how to solve word problems - Utilize program translations (if available) for L1/ L2 students - Reword questions in simpler language - Make use of the ELL Mathematical Language Routines (click here for additional information) -Scaffolding instruction for ELL Learners -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 16-17)
Gifted and Talented:	**Students at Risk for Failure:**
- Elevated contextual complexity - Inquiry based or open ended assignments and projects - More time to study concepts with greater depth - Promote the synthesis of concepts and making real world connections - Provide students with enrichment practice that are imbedded in the curriculum such as: • Application / Conceptual Development • Are you ready for more? - Common Core Approach to Differentiate Instruction: Students with Disabilities (pg. 20) - Provide opportunities for math competitions	- Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum - Modify Instructional Strategies, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Field Trips, Google Expeditions, Peer Support, one on one instruction - Assure constant parental/ guardian contact throughout the year with successes/ challenges - Provide academic contracts to students and guardians - Create an interactive notebook with samples, key vocabulary words, student goals/ objectives. - Always plan to address students at risk in your learning

- Alternative instruction pathways available	tasks, instructions, and directions. Try to anticipate where the needs will be and then address them prior to lessons. -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 19)

21st Century Life and Career Skills:

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

https://www.state.nj.us/education/cccs/2014/career/9.pdf

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2**. Apply appropriate academic and technical skills.
- **CRP3**. Attend to personal health and financial well-being.
- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5**. Consider the environmental, social and economic impacts of decisions.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP7**. Employ valid and reliable research strategies.
- **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9**. Model integrity, ethical leadership and effective management.
- **CRP10**. Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.

Students are given an opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are encouraged to reason through experiences that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, calculators, and educational websites.

Technology Standards:

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information, and ideas.

https://www.state.nj.us/education/cccs/2014/tech/

8.1 Educational Technology:

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

A. **Technology Operations and Concepts:** Students demonstrate a sound understanding of technology concepts, systems and operations.
B. **Creativity and Innovation:** Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
C. **Communication and Collaboration:** Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
D. **Digital Citizenship:** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
E. **Research and Information Fluency:** Students apply digital tools to gather, evaluate, and use of information.
F. **Critical thinking, problem solving, and decision making:** Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:

All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

A. **The Nature of Technology: Creativity and Innovation-** Technology systems impact every aspect of the world in which we live.
B. **Technology and Society:** Knowledge and understanding of human, cultural, and societal values are fundamental when designing technological systems and products in the global society.
C. **Design:** The design process is a systematic approach to solving problems.
D. **Abilities in a Technological World:** The designed world in a product of a design process that provides the means to convert resources into products and systems.
E. **Computational Thinking: Programming-** Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

Interdisciplinary Connections:	
English Language Arts:	
ELA.LITERACY.RI-9-10.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).
ELA-LITERACY.SL.9-10.4	Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
ELA-LITERACY.W.9-10.2.A	Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

Assessment Framework

Assessment	Assignment Type	Grading	Source	Estimated in-class time	When?
Diagnostic Assessment *Unit 3 Diagnostic*	Diagnostic Assessment	Traditional (zero weight)	Curriculum Dept. created – see Dropbox	1 period	Beginning of unit
Mid-Unit Assessment	Formative Assessment	Traditional	Teacher created using "Assessments" in Agile Mind	1-2 periods	Mid unit (optional, must have 3 tests per MP)
Benchmark Assessment	Summative Assessment	Traditional	Curriculum Dept. created	2 periods	End of unit
ECRs	Performance Assessment	Rubric	Curriculum Dept. Created	½ period for each ECR	Last week of each month
Performance Task *Unit 3 Performance Tasks*	Performance Assessment	Rubric	Teacher co-created Assessment	2 periods	In topic 3
Quizzes	Formative Assessment	Rubric or Traditional	Teacher created or "Practice" in Agile Minds	< ½ block	Varies (must have 3 quizzes per MP)
Daily Exit Ticket	Formative Assessment	Varies	Teacher created	3-5 minutes	Daily

NWEA Map Spring Test Window: TBD

Benchmark Assessment Window: 3/23/2020 – 4/3/2020

Topic 7: Properties of a Triangle

Topic Objectives (Note: these are not in 3-part or SMART objective format)

1) Prove that the measures of the angles of a triangle sum to 180 degrees
2) Understand and apply conjectures of isosceles triangles

Focused Mathematical Practices

- MP 2: Reason abstractly and quantitatively
- MP 3: Construct viable arguments and critique the reasoning of others
- MP 5: Use appropriate tools strategically
- MP 6: Attend to precision

Vocabulary

- ***Core***: rigid, scalene triangle, equilateral triangle, isosceles triangle, mid-segment, adjacent interior angles, remote interior angles, exterior angles, vertex angle of an isosceles triangle, altitude, and median
- ***Previous***: complementary angles, supplementary angles, transversal, alternate interior angles, collinear, angle addition postulate, bisector, perpendicular bisector, right angle, and right triangle

Fluency

- Solving linear equations
- Properties of equality (understanding each property and naming them as a way to justify steps in the process of solving an equation)

Suggested Topic Structure and Pacing

Period	Objective(s) covered	Agile Mind "Blocks" (see Professional Support for further lesson details)	MP	Additional Notes
1-2		Block 1	2, 3, 5, 6	
3-4	1	*Block 2,3*	2, 3, 5, 6	In Block 4, skip the constructed response and give as a performance task in Block 6.
5	2	*Block 4*	2, 3, 5, 6	Use Period 5 to give the constructive response (Unit 3 Performance Task – Reasoning #1) NOTE: students will also have an opportunity in Topic 10 to prove properties about isosceles triangles

CCSS	**Concepts** What students will know	**Skills** What students will be able to do
G.CO.10: Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; ~~the segment joining midpoints of two sides of~~	***Review*** • Basic understanding of triangles • Complementary angles are two angles whose measure sum to 90 degrees • Rigid transformations (Unit 1) • The measures of angles that form a straight angle sum to 180 degrees • If two parallel lines are cut by a transversal, then their corresponding	***Review*** • Justify algebraic steps with properties • Use patty paper to draw triangles ***New*** • Construct triangles given 3 side lengths • Discover special relationships between the lengths of sides of triangles • Prove that the sum of the angles in a triangle add up to 180 degrees

Topic 8: Dilations and Similarity

Topic Objectives (Note: these are not in 3-part or SMART objective format)

- Use dilations to define similar polygons by their sides and angles
- Dilate a polygon without a coordinate grid
- Analyze the relationships between the pre-image and image of a dilation
- Describe the transformation under a dilation by various scale factors, including negative scale factors
- Apply dilations on a coordinate grid, including dilations with centers away from the origin
- Partition a line segment using a dilation, including finding the midpoint of the segment
- Describe dilations of lines
- Use the AA, SAS, and SSS postulates for similarity to prove two triangles similar
- Use similarity and proportional reasoning to solve problems

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 2: Reason abstractly and quantitatively
- MP 3: Construct viable arguments and critique the reasoning of others
- MP 5: Use appropriate tools strategically
- MP 6: Attend to precision

Vocabulary

- ***Core***: Dilation, Similarity, Similar Triangle, Proportional, Corresponding Angles, Corresponding Sides, Scale, Negative Scale, Postulates : SSS, AA, and SAS

Suggested Topic Structure and Pacing

Period	Objective(s) covered	Agile Mind "Blocks" (see Professional Support for further lesson details)	MP	Additional Notes
1	1, 2	Block 1 Block 2	2, 5	
2	3,4	Block 3	1, 2, 6	
3	5,6,7	*Block 4*	1, 2, 3, 6	
4	8	Block 5	1, 2, 6	
5	9	Block 6	2	
6-8	9	Block 7	1, 2, 6	Use automatically scored test from Agile Mind to evaluate students' mastery for the topic

CCSS	**Concepts** What students will know	**Skills** What students will be able to do
G.SRT.1: Verify experimentally the properties of dilations given by a center and a scale factor: 1a. A dilation takes a line not passing through the center of	***Review*** • Concept of dilation • Concept of similarity in Geometry ***New*** • Understand the dilation is not a rigid transformation • Understand the image of dilation is	***Review*** • Solving for a missing side length in a pair of similar triangles using proportions • Writing equations of lines • Graphing points in the coordinate plane • Finding the intersection of two lines • Calculating the slope of parallel lines

the dilation to a parallel line, and leaves a line passing through the center unchanged. 1b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. G.SRT.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 G.SRT.3: Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. G-SRT.5: Use ~~congruence and~~ similarity criteria for triangles to solve problems ~~and to prove relationships in geometric figures.~~ G-GPE.6: Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	similar to its pre-image • Understand the reasons of postulate AA, SSS, and SAS for proving similar triangles.	***New*** • Generating similar figures with dilations or scaling • Dilate a polygon on a coordinate plane • Use dilation rule on a coordinate plane to graph an image • Use the AA, ASA, and SSS to prove similar triangles • Create an image for given center and scale factor of a dilation • Dilate an image from origin and other centers

Topic 9: Applications of Similarity

Topic Objectives (Note: these are not in 3-part or SMART objective format)

1) Understand the definition of a midsegment of a triangle
2) Solve problems involving proportional relationships in triangles and between parallel lines
3) Know and apply the definition of geometric mean
4) Solve problems of length involving geometric mean

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 2: Reason abstractly and quantitatively
- MP 3: Construct viable arguments and critique the reasoning of others
- MP 5: Use appropriate tools strategically
- MP 6: Attend to precision

Vocabulary

- ***Core***: midsegment, proportion, geometric mean, altitude, hypotenuse, similar triangles, midpoint

Suggested Topic Structure and Pacing

Period	Objective(s) covered	Agile Mind "Blocks" (see Professional Support for further lesson details)	MP	Additional Notes
1-2	1, 2,	Block 1	2, 5	
3-4	3, 4	*Block 2*	1, 2, 6	
5	1,2,3,4	*Block 5*	1, 2, 3, 6	Use Period 5 to give the program provided Guided practice

CCSS	**Concepts** What students will know	**Skills** What students will be able to do
G.CO.10: Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; ~~the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length;~~ the medians of a triangle meet at a point G-SRT.4: Prove theorems about triangles. *Theorems include: ~~a line parallel to one side of a triangle divides the other two proportionally, and~~*	***Review*** • Concept of similarity • Meaning of AA and SAS similarity postulates ***New*** • Develop conjectures about midsegment of a triangle • Develop conjectures about proportional relationships between parallel lines • Understand the meaning of geometric mean of two numbers	***Review*** • Apply the definition of similar triangles to find missing side lengths • Use AA and SAS similarity postulates • Apply the definition of complementary angles, midpoint, and parallel lines • Use the corresponding angles postulate for parallel lines • Finding the arithmetic mean • ***New*** • Solve problems involving proportional relationships in triangles • Use geometric mean to solve problems

~~*conversely;* the *Pythagorean Theorem proved using triangle similarity*.~~ G-SRT.5: Use ~~congruence and~~ similarity criteria for triangles to solve problems ~~and to prove relationships in geometric figures.~~		

Topic 10: Congruent Triangle Postulates

Topic Objectives (Note: these are not in 3-part or SMART objective format)

1) Use the definition of rigid motion to explain and prove if two triangles are congruent
2) Use congruence criteria for triangles to solve problems and prove relationships

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 2: Reason abstractly and quantitatively
- MP 3: Construct viable arguments and critique the reasoning of others
- MP 5: Use appropriate tools strategically
- MP 6: Attend to precision

Vocabulary

- ***Core***: triangle congruence. Key terms introduced or being reviewed in this topic include rigid transformations, tessellation, semi-regular tessellation, congruent triangles, correspondence, included angle, included side, midpoint, vertical angles, alternate interior angles, transversals, postulates, and Pythagorean Theorem, SSS, AAA, SAS, SSA, ASA, and SAA, along with Hypotenuse-Leg Conjecture (HL).

Fluency

- Solving quadratic equations

Suggested Topic Structure and Pacing

Period	Objective(s) covered	Agile Mind "Blocks" (see Professional Support for further lesson details)	MP	Additional Notes
1-2	1	Block 1, 2	2, 5	
3-4	1,2	Block 3, 4	1, 2, 6	
5-6	1,2	Block 5,6	1, 2, 3, 6	Use Period 6 to give the Unit 3 Performance Task – Major Work

CCSS	**Concepts** What students will know	**Skills** What students will be able to do
G.CO.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. G.CO.7: Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if	***Review*** • The base angles of an isosceles triangle are congruent • The measure of the interior angles in a triangle sum to 180 degrees • Basic understanding of congruent figures • Properties involving parallel lines and transversals ***New*** • To prove two triangles congruent by the definition of congruent triangles, there needs to be 6 pairs of congruent sides and angles; there are shortcuts/congruent triangle postulates that can be used to prove two triangles	***Review*** • Understand and use correct notation for triangles, their sides, and their angles • Use a protractor, ruler, and patty paper • Using Pythagorean's Theorem • Create a two column or informal proof ***New*** • Explain and prove if two triangles are congruent using the definition of rigid motion • Use congruent triangle postulates to solve problems and prove relationships involving triangles

corresponding pairs of sides and corresponding pairs of angles are congruent. G.CO.8: Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions. G.SRT.5: Use congruence ~~and similarity criteria~~ for triangles to solve problems ~~and to prove relationships in geometric figures~~	congruent • If three sides of one triangle are congruent to three sides of another triangle, then the triangles are congruent • 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 angles and the included side of one triangle are congruent to two angles and the included side of another triangle, then the triangles are congruent • If two angles and the non-included side of one triangle are congruent to two angles and the non-included side of another triangle, then the triangles are congruent • If the hypotenuse and a leg of one right triangle are congruent to the hypotenuse and one leg of another right triangle, then the triangles are congruent	

Topic Objectives (Note: these are not in 3-part or SMART objective format)

1) Use congruence criteria for triangles to solve problems and to prove relationships in geometric figures

Focused Mathematical Practices

- MP 1: Make sense of problems and persevere in solving them
- MP 2: Reason abstractly and quantitatively
- MP 3: Construct viable arguments and critique the reasoning of others
- MP 6: Attend to precision

Vocabulary

- ***Core***: CPCTC (Corresponding parts of congruent triangles are congruent), auxiliary line, and isosceles triangle theorem
- ***Previous***: congruent triangle postulate, vertical angles, reflexive property, two-column proof, bisector, median, base angle, converse, and segment/angle addition postulate
- ***Academic***: symbolic, guarantee, overlap, corresponding, adjacent, scale, proceed, and precede

Fluency

- Solving quadratic equations

Suggested Topic Structure and Pacing

Period	Objective(s) covered	Agile Mind "Blocks" (see Professional Support for further lesson details)	MP	Additional Notes
1-2	1	Block 1-3	1, 2, 3, 6	
3	1	Block 4-5	1, 2, 3, 6	
4	1	Block 6	1, 2, 3, 6	Use Period 4 to administer a quiz or Unit 3 Performance Task – Reasoning #2

CCSS	**Concepts** What students will know	**Skills** What students will be able to do
G.CO.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. G.CO.10: Prove theorems about triangles. Theorems include: ~~measures of interior angles of a triangle sum to 180°;~~ base angles of isosceles triangles are congruent; ~~the segment~~	***Review*** • Algebraic properties of equality • Definition of angle bisector, perpendicular bisector, median • Vertical angles are congruent • The base angles of an isosceles triangle are congruent • Congruent triangle postulates • Segment addition postulate ***New*** • You must always prove two triangles congruent before using CPCTC • In a proof, you never use CPCTC as a reason for why two triangles are congruent • If CPCTC is used as reason, the	***Review*** • Create informal, two-column, and flow chart proofs ***New*** • Prove relationships involving isosceles triangles: base angles are congruent, sides opposite the base angles are congruent, the median of the base, bisects the non base angle, the median of the base is the perpendicular bisector of the base side • Use congruence criteria for triangles to solve problems and to prove relationships in geometric figures

~~joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.~~ G.SRT.5: Use congruence ~~and similarity~~ criteria for triangles to solve problems and to prove relationships in geometric figures	statement will be two line segments or two angles are congruent • In a triangle, the side opposite an angle is the side that is not contained by one of the rays that forms the angle. • If two angles of a triangle are congruent, then the sides opposite those angles are also congruent • An auxiliary line is the unique line through any two points	

5 Practices for Orchestrating Productive Mathematics Discussions	
Practice	**Description/ Questions**
1. Anticipating	**What strategies are students likely to use to approach or solve a challenging high-level mathematical task?** **How do you respond to the work that students are likely to produce?** **Which strategies from student work will be most useful in addressing the mathematical goals?**
2. Monitoring	**Paying attention to what and how students are thinking during the lesson.** **Students working in pairs or groups** **Listening to and making note of what students are discussing and the strategies they are using** **Asking students questions that will help them stay on track or help them think more deeply about the task. (Promote productive struggle)**
3. Selecting	**This is the process of deciding the *what* and the *who* to focus on during the discussion.**
4. Sequencing	**What order will the solutions be shared with the class?**
5. Connecting	**Asking the questions that will make the mathematics explicit and understandable.** **Focus must be on mathematical meaning and relationships; making links between mathematical ideas and representations.**

Ideal Math Block

The following outline is the department approved ideal math block for grades 9-12.

1) Fluency Practice (5 min) (see focused fluency skills in each curriculum unit plan)

2) Do Now (7-10 min)
    a. Serves as review from last class' or of prerequisite material
    b. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

3) Starter/Launch (5 min)
    a. Designed to introduce the lesson
    b. Uses concrete or pictorial examples
    c. Attempts to bridge the gap between grade level deficits and rigorous, on grade level content
    d. Provides multiple entry points so that it is accessible by all students and quickly scaffolds up

4) Mini-Lesson (15-20 min)
    a. Design varies based on content
    b. May include an investigative approach, direct instruction approach, whole class discussion led approach, etc.
    c. Includes CFU's
    d. Anticipates misconceptions and addresses common mistakes

5) Class Activity (25-30 min)
    a. Design varies based on content
    b. May include partner work, group work/project, experiments, investigations, game based activities, etc.

6) Independent Practice (7-10 min)
    a. Provides students an opportunity to work/think independently

7) Closure (5-10 min)
    a. Connects lesson/activities to big ideas
    b. Allows students to reflect and summarize what they have learned
    c. May occur after the activity or independent practice depending on the content and objective

8) DOL (5 min)
    a. Exit slip

Idea Math Block with Intervention Stations

Whole Group Instruction	50 min	INSTRUCTION (Grades 9 – 12) Daily Routine: Mathematical Content or Language Routine Anchor Task: Anticipate, Monitor, Select, Sequence, Connect Collaborative Work* Guided Practice Independent Work (Demonstration of Student Thinking)	TOOLS Manipulatives RESOURCES Agile Mind

Rotation Stations (Student Notebooks & Chromebooks Needed)	1-2X 35 min	STATION 1: Focus on current Grade Level Content STUDENT EXPLORATION* Independent or groups of 2-3 Emphasis on MP's 3, 6 (Reasoning and Precision) And MP's 1 & 4 (Problem Solving and Application) TOOLS/RESOURCES Agile Mind Math Journals	STATION 2: Focus on Student Needs TECH STATION Independent TOOLS/ RESOURCES Khan Academy Approved Digital Provider Fluency Practice	TEACHER STATION: Focus on Grade Level Content; heavily scaffolded to connect deficiencies TARGETED INSTRUCTION 4 – 5 Students TOOLS/ RESOURCES Agile Homework Manipulatives

	5 min	INSTRUCTION Exit Ticket (Demonstration of Student Thinking) TOOLS/RESOURCES Notebooks or Exit Ticket Slips

Sample Lesson Plan

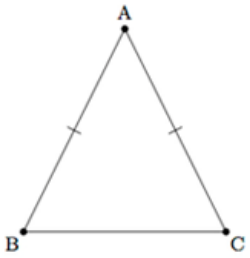
Lesson		Days	1
Objective	After exploring characteristics of isosceles triangles, students will understand and apply isosceles triangle conjectures with 2 out of 2 correct on an exit ticket By engaging in a performance task, students will prove theorems and apply properties about angles in a triangle with a rubric score of at least a 4.	**NJSLS**	G.CO.10
Learning activities/strategies	**Materials needed:** Patty Paper, a straight edge, and a pencil **Do Now (4 minutes):** • Fluency check: Solve the linear equation and justify each step with an algebraic reason or property. • $2x - 8 = 5(x + 4)$ **Starter/Launch (4 minutes):** • Introduce objectives (let students know they will be taking a performance task today) • Have students write down as many things as they know about isosceles triangles (examples, non-examples, definition, characteristics, etc) • Share ideas as a class OR have students compare list in pairs **Mini lesson and exploration (20 minutes):** • Pages 1-3, Exploring Isosceles Triangle Conjectures ○ Have students follow along the animation on page 1. [SAS 4, question 1] ○ Have students work in groups to find relationships that occur in the isosceles triangle. ○ Page 2 has some prompting questions if needed. [SAS 4, questions 2] ○ Language strategy. Highlight the definition of the vertex of an isosceles triangle. Have students read the definition in pairs and draw an example and a non-example on paper. Have students share their examples and non-examples with the class. ○ As pairs or small groups, have students complete the puzzle on page 3 to further explore the properties of isosceles triangles. [SAS 4, question 3] ○ Discuss any true conjectures that are in the puzzle but students did not find on their own. • Page 4 ○ Use this page to summarize the observations students made using Patty Paper in verbal statements. [SAS 4, question 4] ○ Point out to students that we will prove these conjectures in a future topic. • Page 5 ○ Use the illustrations on this page to discuss the terms median and altitude of a triangle. ○ Point out that these definitions are true for any triangle ○ How many medians will a triangle have? ○ How many altitudes will a triangle have?		

	○ Where is one of the medians of the patty paper isosceles triangle you made? ○ Where is one of the altitudes of the patty paper isosceles triangle you made? ○ How can you rewrite the last two conjectures you made about isosceles triangles using this new vocabulary? ○ The conjectures talk about the segment from the vertex angle of the isosceles triangle. ○ What do you think is true about the other medians and altitudes of the isosceles triangle? [The point of this question is for students to realize that only one of the medians and altitudes are the same in an isosceles triangle, not all three.] ○ What do you think would be true about the medians and altitudes of an equilateral triangle? **Practice (10 minutes):** • Students work independently Guided Practice #9-10 and More Practice #14-17 **Closure (3 minutes):** • Have students list one thing they learned today that they did not previously know, or something they already knew (or had an idea of) that they now have a better understanding of • HW: SAS 4, #4-6 **DOL (3 minutes):** • Automatically Scored assessment questions #8-9 **Performance Task (30 minutes)** • Students independently take Unit 3 Performance Task #1 which is the Topic 7 Constructed Response question under the Assessment

Sample Performance Assessment

Unit 3 Performance Task –
Name: _____ Date

Below is an isosceles triangle ABC with |AB|=|AC|:



Three students propose different arguments for why **m(∠B)=m(∠C)**. Fill in the details in each argument to show why **m(∠B)=m(∠C)**.

a. Ravi says: ***If I draw the bisector of*** ∠A ***then this is a line of symmetry for*** △ABC ***and so*** m(∠B)=m(∠C)**.**

b. Brittney says: If M ***is the midpoint of BC then*** △ABM ***is congruent to*** △ACM ***and so*** ∠B ***and*** ∠C ***are congruent.***

c. Courtney says: If ***P is a point on BC such that AP is perpendicular to BC then*** △ABP ***is congruent to*** △ACP ***and so*** ∠B ***and*** ∠C ***are congruent.***

Link of Performance Task:
https://www.dropbox.com/sh/yja6vztzhiqmth4/AACB3R6pv4CmAhRkYpGn6kW-a?dl=0

Sample Rubric of Performance Task

Geometry Reasoning Performance Task (*Isosceles Triangle*) – Rubric

Name: _____ Date: _____

NJSLS: G.CO.10 ***SMP***: MP 2, MP 3, MP 6

Task Description	➢ Uses precise vocabulary, properties, and theorems ➢ Applies algebraic properties to prove a geometric theorem ➢ Construct an argument by evaluating and critiquing the reasoning of others ➢ Proves that the base angles of an isosceles triangle are congruent				
Command Level Description	***Level 5: Distinguished Command*** Perform the task items accurately or with minor computation errors. (100%)	***Level 4: Strong Command*** Perform the task items with some non-conceptual errors (89%)	***Level 3: Moderate Command*** Perform the task items with minor conceptual errors and some computation errors. (79%)	***Level 2: Partial Command*** Perform the task items with some errors on both math concept and computation. (69%)	***Level 1:*** Perform the task items with serious errors on both math concept and computation. (59%)
Score range	9+ pts	7-8 pts	5-6 pts	3-4 pt	0-2 pts
Task Score & PLD Assigned					
Teacher Feedback					

Extended Constructed Response (ECR)

Math Department ECR Protocol

ECR Protocol

(Extended Constructed Response)

Issuing

- Moving forward ECR'S will be disseminated by the first of each month and collected by the end of each month
- Method of Issuing: email and post on the website

Dissemination

- Teachers can elect to print copies for each student or use the Smartboard to project the ECR. (Note: Student work will be included in Student Portfolios)
- Students should be given up to 30 minutes depending on the complexity of the ECR
- Assure appropriate testing environment
- ECR should be completed independently

Scoring

- Conversion tables are available in the *Assessment & Data in Mathematics Bulletin* for genesis inputting purposes
- ECR's will count as Authentic Assessments
- Naming Protocol "Course Month ECR" (ex: Grade 6 October ECR)

Collection

- ECR's will be collected & kept in student portfolios
- Student work will be reviewed during CPT's

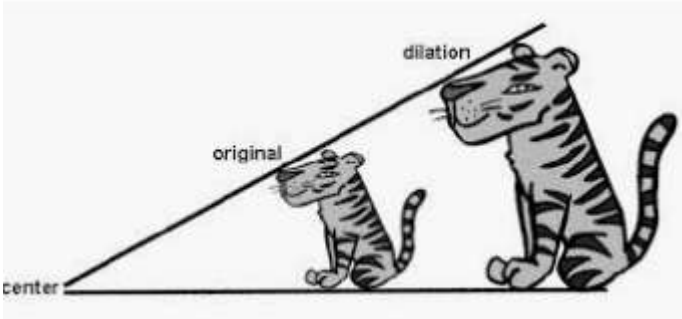
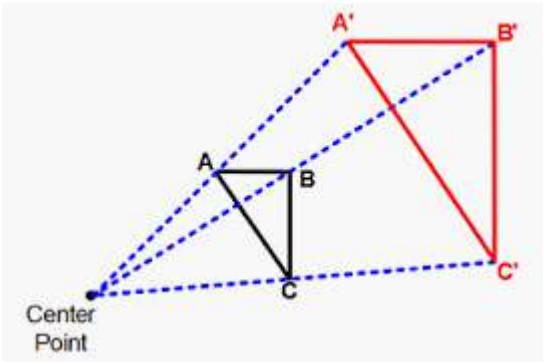
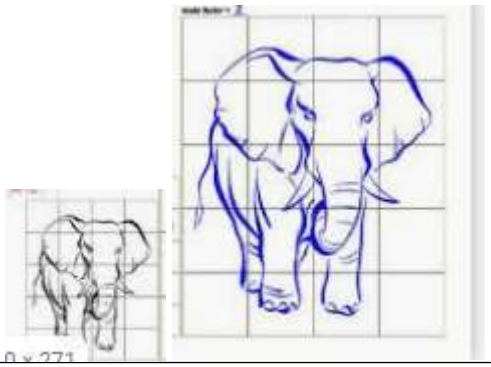
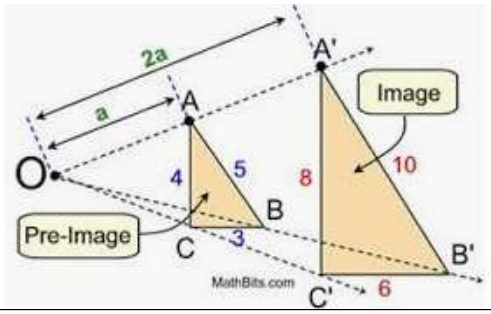
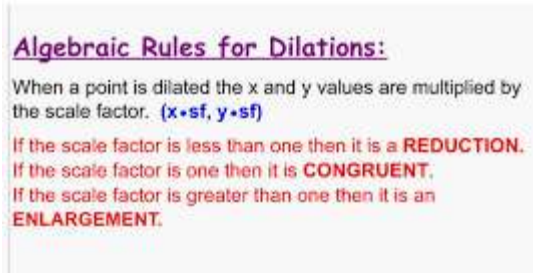
Link of Unit 3 ECRs

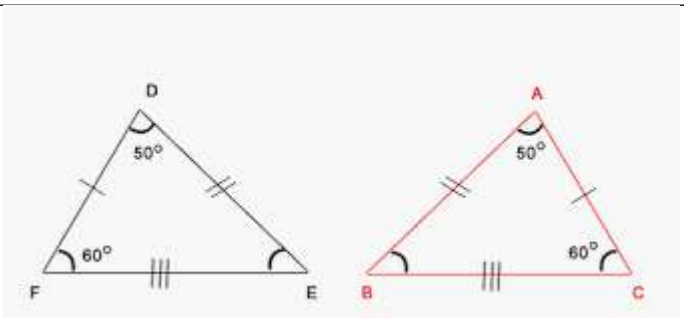
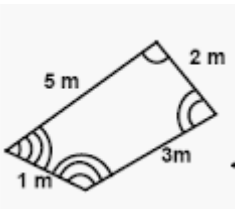
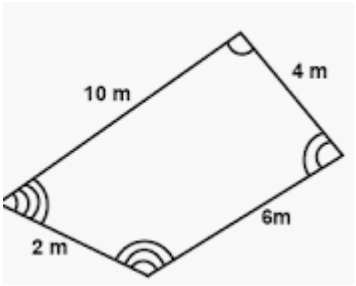
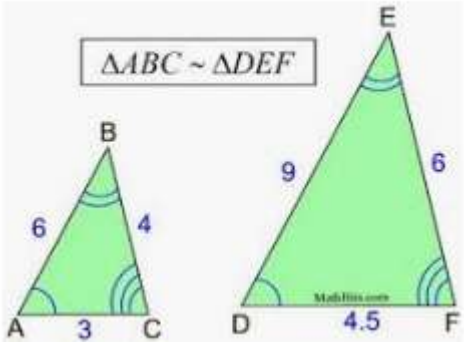
https://www.dropbox.com/sh/yujzxex28eebxsj/AAD99HcYHhjEQ_ym1FnfXcTRa?dl=0

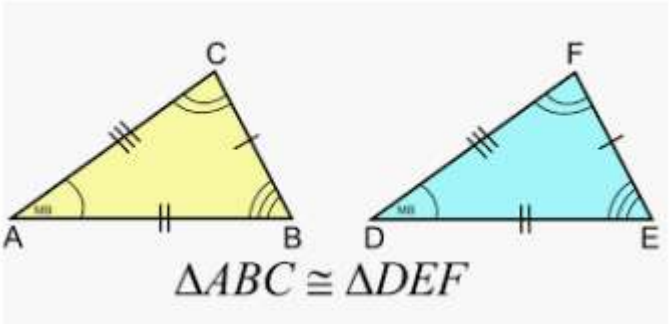
ECR Conversion Chart

Points	Genesis Conversion	Points	Genesis Conversion	Points	Genesis Conversion
0	55	0	55	0	55
1	59	1	69	1	69
2	69	2	79	2	89
3	79	3	89	3	100
4	89	4	100		
5	100				

Multiple Representations

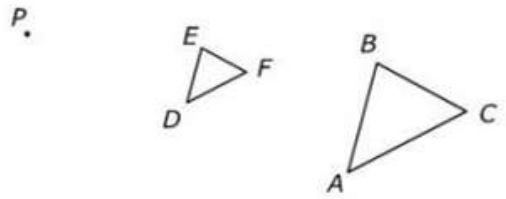
Representations	Dilation
Concert Representation	
Pictorial Representation	  
Symbolic Representation	Algebraic rule of Dilation 

Representation	Similar Figures
Concreate Representation	 
Pictorial Representation	  
Symbolic Representation	

	Congruent Triangle
Concrete Representation	 
Pictorial/Symbolic	

NJSLA Sample Items

Triangle *ABC* is dilated with scale factor $\frac{1}{2}$ and center *P* onto triangle *DEF*.



Which statements must be true?

Select **all** that apply.

- ☐ A. $\overline{AB} \parallel \overline{DE}$
- ☐ B. $m\angle A = m\angle F$
- ☐ C. $m\angle B = m\angle E$
- ☐ D. The length of segment *AC* is twice the length of segment *DF*.
- ☐ E. The length of segment *EF* is twice the length of segment *BC*.

Consider the three transformations described:

- Triangle *ABC* is the image of $\triangle XYZ$ after a reflection across $\overline{XY}$.
- Triangle *DEF* is the image of $\triangle XYZ$ after a rotation of 180° about point *X*.
- Triangle *GHJ* is the image of $\triangle XYZ$ after a dilation of scale factor $\frac{2}{3}$ centered at point *X*.

Determine whether each statement is true or false.

Select the boxes to identify whether each statement is true or false.

Statement	True	False
$\triangle ABC \cong \triangle XYZ$	○	○
$\triangle DEF \cong \triangle XYZ$	○	○
$\triangle GHJ \cong \triangle XYZ$	○	○

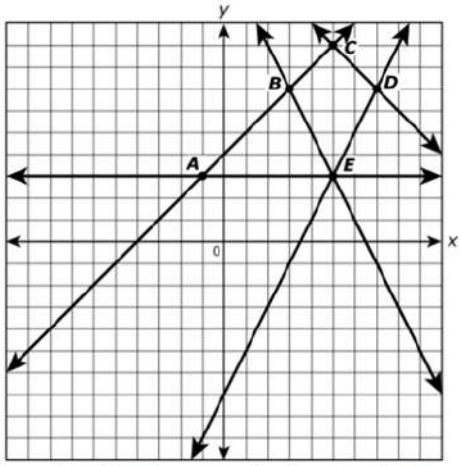
Segment AB has endpoints $A(-2, 8)$ and $B(4, 0)$. The segment is dilated about the origin by a scale factor of 0.5 to create segment $A'B'$.

What are the endpoints of segment $A'B'$?

Select **both** endpoints.

- A. $(-2, 8)$
- B. $(-1, 4)$
- C. $(0, 0)$
- D. $(1, 4)$
- E. $(2, 0)$
- F. $(4, 0)$

The image shown will undergo a dilation centered at point B, with a scale factor of 2.



Which lines will **not** be changed by the transformation?

Select **all** that apply.

- A. $\overleftrightarrow{AC}$
- B. $\overleftrightarrow{AE}$
- C. $\overleftrightarrow{BE}$
- D. $\overleftrightarrow{CD}$
- E. $\overleftrightarrow{DE}$

Supplement Resources

Topic	Link
Lines in Triangles	https://www.dropbox.com/s/trcvfnyes1cn85q/Unit%203%20Task%201%20Guided%20Notes%20Lines%20in%20Triangles.doc?dl=0
Triangle Inequality Theorem	https://www.dropbox.com/s/drroxd0h9pbz8ki/Unit%203%20Task%202%20Triangle%20Inequality%20Theorem%20Hinge%20Theorem.docx?dl=0
Sum of Triangle Interior Angles	https://www.dropbox.com/s/eckdc4wf78ht2ud/Unit%203%20Task%203%20Triangle%20Sum%20Exterior%20Angle%20Theorem.docx?dl=0
Isosceles & Equilateral Triangle	https://www.dropbox.com/s/eht6ere36l7dmlx/Unit%203%20Task%204%20Isosceles%20and%20Equilateral%20Triangles.doc?dl=0
Def. of Congruent Triangles	https://www.dropbox.com/s/jdwz51d79fwp3ir/Unit%203%20Task%205%20Def%20of%20Congruent%20Triangles.docx?dl=0
Congruent Postulate	https://www.dropbox.com/s/6jfl1osybd2f2ia/Unit%203%20Task%206%20SSS%20SAS%20ASA%20AAS.docx?dl=0
Making Diagram	https://www.dropbox.com/s/wi3rc06ocojs0wv/Unit%203%20Task%207%20Practice%20Marking%20Diagram.pdf?dl=0
CPCTC	https://www.dropbox.com/s/ua86rylmgovpx5i/Unit%203%20Task%209%20CPCTC.docx?dl=0
Deterring Similarity	https://www.dropbox.com/s/qjmxivg1c8ojyly/Unit%204%20Task%201%20Determining%20Similarity.doc?dl=0
Similar Triangles & Shadows	https://www.dropbox.com/s/kk9heqrbu95krfg/Unit%204%20Task%202%20-%20Similar%20Triangles%20and%20Shadows.doc?dl=0