

Unit 5

Congruence and Triangles

Standards

- 2.4 Use inequalities in one triangle and inequalities between two triangles (Hinge Theorem) to solve problems.
- 3.1 State the postulate or theorem (SSS, SAS, ASA, AAS, HL) that justifies the congruence of two triangles.
- 3.2 Write paragraph proofs to demonstrate the congruence of triangles and its corresponding parts.
- 5.1 Determine the image of given figures under specified translations, reflections, rotations, and dilations.
- 5.2 Describe the type of symmetry for given designs.

Algebra II

- 11.1 Solve quadratic equations by “completing the square” and by using the Quadratic Formula.

Day 1 Symmetry and Reflection

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Vocabulary used in classifying triangles and quadrilaterals. 	<ul style="list-style-type: none"> Determine lines of symmetry. Determine the images of figures under specified reflections and/or rotations. 	<ul style="list-style-type: none"> Prove triangles are congruent.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	<ul style="list-style-type: none"> Complete CG-1 with teacher and team. 	<ul style="list-style-type: none"> Demonstrate how the line of symmetry divides a figure so that each side folds over the line to fit the other side exactly. Provide students with mirrors or reflectors. Students tend to use the diagonals of the parallelogram as lines of symmetry. Suggest drawing the lines of symmetry as dotted lines. 	<ul style="list-style-type: none"> Transformations are used as a means of developing understanding of congruence. Some figures have more than one line of symmetry.
Explore 20-25 minutes	<ul style="list-style-type: none"> Add Definitions from CG-1 to toolkit. Complete CG-2, CG-3, CG-4, and CG-5 with study team. 	<ul style="list-style-type: none"> Anticipate difficulties when students are drawing reflections. Help students draw figures 	<ul style="list-style-type: none"> The work in transformation is mostly informal. The language of flips, turns,

Steps	Student Activity	Teacher Support	Comment/Evaluation
		systematically by breaking figure into parts. <ul style="list-style-type: none"> • What do students notice about the segments joining the vertices of the image and the pre-image? • What do students notice about the relationships in shape and size of the image and pre-image? 	and slides may be used. <ul style="list-style-type: none"> • Do not get caught in the formalism of transformation.
Summary 8-10 minutes	<ul style="list-style-type: none"> • Add CG-5 to toolkit. • Discuss CG-4 with class. 	<ul style="list-style-type: none"> • Guide students into seeing that figures can be congruent even when they are reversed in orientation. • Colors may be used to identify corresponding parts. 	
Homework	<ul style="list-style-type: none"> • CG-6 – CG10. 	<ul style="list-style-type: none"> • CG-6 and CG-7 are review of factoring quadratics and may need to be reviewed during lesson in day 2. 	

Day 2
Translation and Rotation

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Determine the image of given figures under reflections of specified lines. 	<ul style="list-style-type: none"> Determine the image of given figures under translations and rotations. 	<ul style="list-style-type: none"> Prove triangles are congruent.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
<p>Launch</p> <p>10-15 minutes</p>	<ul style="list-style-type: none"> Follow teacher demonstration of translation and rotation of figures. 	<ul style="list-style-type: none"> Demonstrate the concept of translation. Plot a triangle or a quadrilateral with specified coordinates for vertices. Select a specified number to add to each of the x-coordinates and another specified number to add to each of the y-coordinates. Plot the resulting triangle or quadrilateral. Label the pre-image and image. Discuss the relationships between the resulting shapes. Demonstrate the concept of rotation by using transparencies or tracing paper. Hold the tracing paper or transparencies with a pin or pencil at 	<ul style="list-style-type: none"> Students need to consider the existence of viewpoints other than one's own, and to put oneself in the shoes of another to see the world from his or her viewpoint. Students need verbal tools for communicating adequately their responses.

Steps	Student Activity	Teacher Support	Comment/Evaluation
		the point of rotations. <ul style="list-style-type: none"> • Rotate the figure. • Provide students with graph paper, together with tracing paper or transparencies so that they may follow the demonstration. 	
Explore 20-25 minutes	<ul style="list-style-type: none"> • Complete CG-11, CG-12 and CG-13 with study team. 	<ul style="list-style-type: none"> • Anticipate difficulties in changing the orientation for rotations. • Have student translate into his own words what he is being asked to do. • Tracing the figures and physically rotating the figure often provides needed spatial references. 	<ul style="list-style-type: none"> • There may be need to talk about rotating counter-clockwise.
Summary 8-10 minutes	<ul style="list-style-type: none"> • Share conclusions on relationships between pre-image and image with class. 	<ul style="list-style-type: none"> • Ask students to share and discuss the strategies and the steps involved in making the image from the pre-image. 	
Homework	<ul style="list-style-type: none"> • CG-14 – CG-19. • Add definitions from CG-11 and CG-12 in toolkit. 		

Day 3 Congruence

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Determine images of given figures under specified translations and rotations. 	<ul style="list-style-type: none"> Use transformations to determine whether given figures are congruent. 	<ul style="list-style-type: none"> Proof triangles are congruent.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	<ul style="list-style-type: none"> Follow teacher and complete CG-20 with class. 	<ul style="list-style-type: none"> Provided tracing paper or onion skin paper for the exploration on transformations. Complete CG-20 with class. 	
Explore 20-25 minutes	<ul style="list-style-type: none"> Complete CG-21, CG-22, and CG-23 with study team. 	<ul style="list-style-type: none"> Students may confuse angle equality with the lengths of the sides (rays) of the angles for CG-21. Encourage students to complete the tracing for CG-21 and CG-22. Introduce congruence, \cong, symbol. Remind students of proper format in listing corresponding labels. Demonstrate the convention of using slash marks to indicate that two or more segments or angles are equal. 	<ul style="list-style-type: none"> Proper use of labeling help students visualize relationships.

Steps	Student Activity	Teacher Support	Comment/Evaluation
Summary 10-15 minutes	<ul style="list-style-type: none"> • Discuss CG-23 with class. • Add definition and labeling conventions from CG-23 to toolkit. 	<ul style="list-style-type: none"> • Select study teams to present discussions of CG-23 with class. 	
Homework	<ul style="list-style-type: none"> • CG-24 – CG-30. 		

Day 4 Congruent Triangles

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Determine images of given figures under specified transformations. 	<ul style="list-style-type: none"> Determine conditions necessary for triangles to be congruent. 	<ul style="list-style-type: none"> Prove triangles are congruent.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	<ul style="list-style-type: none"> Add definitions from CG-31 to toolkit. 	<ul style="list-style-type: none"> Reinforce the proper format for naming and writing the six parts of the triangles. If two triangles are congruent, the six corresponding parts are congruent, and vice versa. 	
Explore 20-25 minutes	<ul style="list-style-type: none"> Complete CG-32, CG-33, and CG-34 with study team. 	<ul style="list-style-type: none"> Students need to be reminded that the lengths of the line segments are fixed, the sides of the angles are rays and the lengths are not fixed. Lead class with demonstration of CG-33. 	<ul style="list-style-type: none"> Directions for CG-32, CG-33, and CG-34 may need to be clarified. CG-32, CG-33, and CG-34 may all be teacher lead demonstrations.
Summary	<ul style="list-style-type: none"> Discussion of CG-33 and CG-34. 	<ul style="list-style-type: none"> Discussions of CG-33 and CG-34 are 	

Steps	Student Activity	Teacher Support	Comment/Evaluation
18-20 minutes		<p>MUSTS to bring the ideas together.</p> <ul style="list-style-type: none"> • Discussions are needed to prevent students from thinking that “because AAA and SSA are in the book, they must be true.” • If time does not permit, begin lesson for day 5 with the discussion. 	
Homework	<ul style="list-style-type: none"> • CG-35 – CG-39. 		<ul style="list-style-type: none"> •

Day 5 Using Congruent Triangles

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Determine images of given figures under specified transformations. 	<ul style="list-style-type: none"> Determine conditions necessary for triangles to be congruent. 	<ul style="list-style-type: none"> Prove triangles are congruent.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	<ul style="list-style-type: none"> Review three triangle congruence properties: SSS, SAS, ASA. in CG-40. 	<ul style="list-style-type: none"> Review the SSS, SAS, ASA triangle congruence properties using CG-40. 	<ul style="list-style-type: none"> Guide students in reaching conclusions related to triangle congruence through investigations rather than just memorization.
Explore 20-25 minutes	<ul style="list-style-type: none"> Complete CG-41, and CG-42 with study team. 	<ul style="list-style-type: none"> Reinforce the use of proper format in writing triangle congruence statements. Guide students in identifying the corresponding parts correctly. Students need to supply a “complete” answer to each part of the questions. 	<ul style="list-style-type: none"> Proper format and complete answers are important for lead into constructing proofs.
Summary	<ul style="list-style-type: none"> Share writings for CG-41 and CG-42 	<ul style="list-style-type: none"> Select study teams to share writings 	

Steps	Student Activity	Teacher Support	Comment/Evaluation
8-10 minutes	with class.	for CG-41 and cG-42 with class.	
Homework	<ul style="list-style-type: none"> • Complete CG-43 and CD-47. 	<ul style="list-style-type: none"> • CG-44 through CG-46 are algebra review. 	

Day 6 Triangle Congruence Proofs

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Show whether given triangles are congruent. 	<ul style="list-style-type: none"> Identify corresponding parts for congruent triangles. 	<ul style="list-style-type: none"> Solve problems related to congruent triangles and its corresponding parts.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	<ul style="list-style-type: none"> Follow teacher demonstration for CG-50 and CG-51. 	<ul style="list-style-type: none"> Complete demonstration of CG-50. Students must understand that (\cong) means that the physical segments or angles are the same size and shape; $(=)$ means that the length of the segments or the measures of the angles are the same. 	<ul style="list-style-type: none"> Once it has been demonstrated that two triangles are congruent, then it may be stated that any of the other pairs of corresponding parts are congruent.
Explore 20-25 minutes	<ul style="list-style-type: none"> Complete CG-52 and CG-53 with study team. 	<ul style="list-style-type: none"> Guide students in using the proper format for writing and justifying statements relating to the congruence of triangles. 	
Summary	<ul style="list-style-type: none"> Share conclusions about triangle congruence with class. 	<ul style="list-style-type: none"> Select study teams to share conclusions related to triangle 	

Steps	Student Activity	Teacher Support	Comment/Evaluation
		congruence with class.	
Homework	<ul style="list-style-type: none">CG-54 – CG-57.	<ul style="list-style-type: none">CG-58 and CG-59 are algebra review.	

Day 7
More Congruence Properties

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Show whether given triangles are congruent. 	<ul style="list-style-type: none"> Identify congruence properties for right triangles. 	<ul style="list-style-type: none"> Solve problems related to congruent triangles and its corresponding parts.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	<ul style="list-style-type: none"> Follow discussion on CG-56 and CG-57 from homework. Complete CG-61. 	<ul style="list-style-type: none"> Begin with discussion on CG-56 and CG-57. Review the Pythagorean Theorem. Complete CG-61. 	
Explore 20-25 minutes	<ul style="list-style-type: none"> Complete CG-62, CG-63, CG-64, and CG-65 with study team. Add CG-63 in toolkit. 	<ul style="list-style-type: none"> Develop HL and show that ASA and AAS are really equivalent. Add CG-63 in toolkit. 	
Summary 8-10 minutes	<ul style="list-style-type: none"> Add CG-63 in toolkit. 	<ul style="list-style-type: none"> Guide students in having all the congruent properties for triangles listed in their toolkits. 	
Homework	<ul style="list-style-type: none"> CG-66 – CG-69, 	<ul style="list-style-type: none"> CG 63 requires Isometric graph paper. 	

Day 8
The Triangle Inequality

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Sketching angles and polygons. 	<ul style="list-style-type: none"> The Triangle Inequality – the property that states maximum and minimum limits for the length of the third sides of any triangle. 	<ul style="list-style-type: none"> Solve problems relating to the six parts of given triangles.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
<p>Launch</p> <p>10-15 minutes</p>	<ul style="list-style-type: none"> Follow teacher demonstration for starting CG-70. 	<ul style="list-style-type: none"> Demonstrate building triangles with centimeter grid paper cut into strips. 	<ul style="list-style-type: none"> Paper is easier to handle than dry linguini. Students do not need to 'measure' if centimeter grid paper is used. Cut centimeter grid paper in strips of 1-centimeter width.
<p>Explore</p> <p>20-25 minutes</p>	<ul style="list-style-type: none"> Complete CG-70 and CG-71 with study team. 	<ul style="list-style-type: none"> Ask students to make a table to record experiments with different lengths for the three sides of triangles. 	<ul style="list-style-type: none"> The Quadratic Formulas section may be postponed for a later time.
<p>Summary</p>	<ul style="list-style-type: none"> Discuss conclusion for Triangle 	<ul style="list-style-type: none"> The Triangle Inequality states the 	

Steps	Student Activity	Teacher Support	Comment/Evaluation
8-10 minutes	Inequality.	maximum and minimum limits for the length of the third side.	
Homework	<ul style="list-style-type: none"> • CG-77 – CG-80. 		

Day 9
Unit Review

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Identify properties to show that triangles are congruent. The Triangle Inequality. 	<ul style="list-style-type: none"> Review properties needed to show that triangles are congruent. Apply the Triangle Inequality. 	<ul style="list-style-type: none"> Solve problems relating to corresponding parts of congruent triangles. Solve problems relating to Triangle Inequality.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	<ul style="list-style-type: none"> Complete CG-81 with teacher. 	<ul style="list-style-type: none"> Complete CG-81 with students. 	
Explore 20-25 minutes	<ul style="list-style-type: none"> Complete CG-82, CG-83, CG-85, CG-86, CG-87, and CG-88 with study team. 	<ul style="list-style-type: none"> Use CG-87 to emphasize the properties needed to show that triangles are congruent. 	
Summarize 8-10 minutes	<ul style="list-style-type: none"> Discuss CG-87. 	<ul style="list-style-type: none"> Select study team to discuss CG-87. 	
Homework	<ul style="list-style-type: none"> CG-82, CG-83, CG-85 – CG-87. 		

Day 10 Unit Review

Connections

Prior Work	Current Big Idea	Future Work
<ul style="list-style-type: none"> Identify properties to show that triangles are congruent. The Triangle Inequality. 	<ul style="list-style-type: none"> Review properties needed to show that triangles are congruent. Apply the Triangle Inequality. 	<ul style="list-style-type: none"> Solve problems relating to corresponding parts of congruent triangles. Solve problems relating to Triangle Inequality.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	<ul style="list-style-type: none"> Complete CG-91 with teacher. 	<ul style="list-style-type: none"> Complete CG-91 with students. 	
Explore 20-25 minutes	<ul style="list-style-type: none"> Complete CG-90, CG-92, CG-95, CG-96, CG-97, and CG-98 with study team. 	<ul style="list-style-type: none"> Complete unit review. 	<ul style="list-style-type: none"> Introduce CG-100, the mini project.
Summary 8-10 minutes	<ul style="list-style-type: none"> Share conclusions to review exercises. 	<ul style="list-style-type: none"> Share conclusions to review exercises. 	
Homework	<ul style="list-style-type: none"> Review of Unit 5. 		

