Unit 4: Polygons, Triangles, and Quadrilaterals

Content Area: **Mathematics**
Course(s): **Geometry Honors 8**
Time Period: **November**
Length: **8 weeks**
Status: **Published**

Transfer

Previous coursework: experimentally proved the triangle sum theorem and the exterior angle theorem

By the end of this unit: Students should use congruent triangles and their corresponding parts frequently in this unit- they should become very good at recognizing how to use CPCTC to prove properties in a variety of scenarios. Each parallelogram's properties should be first addressed as a proof, and then reinforced with practice involving algebra. The side and angle measure properties of each of the parallelograms should be stressed to prepare for coordinate geometry. Remember, the general focus of the high school geometry course to formalize concepts previously address informally.

Instructional Strategies:

- This unit is all about applying the skills in the previous unit to new situations- encourage group work and analyzing peer's work.
- There is no mention of trapezoids and kites in the common core, but you can address them briefly, if time allows, to prove their properties.
- (+) = denotes Honors only skill not on PARCC

Essential Questions

Why are congruent triangles useful in proofs?

Why are parallelograms important?

Enduring Understandings

Congruent triangles have corresponding parts that are congruent, which can help us prove other properties about lines and special triangles.

Parallelograms have two sets of parallel sides and can be divided into triangles, these qualities lead to these

special quadrilaterals having a plethora of other properties.

Standards in Mathematics

MA.8.G.A	Understand congruence and similarity using physical models, transparencies, or geometry software.
MA.8.G.A.2	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
MA.G-C.A	Understand and apply theorems about circles
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	Prove geometric theorems
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	Make geometric constructions
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.G-CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.G-GPE.B	Use coordinates to prove simple geometric theorems algebraically
MA.G-GPE.B.4	Use coordinates to prove simple geometric theorems algebraically.
MA.G-GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.
MA.G-SRT.B	Prove theorems involving similarity
MA.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.
	Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant

external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

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

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

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

Critical Knowledge and Skills

Vocabulary

Using Congruent Triangles in Proofs (CPCTC)

Proving Parallelogram Properties

Applying Parallelogram Properties

Learning Objectives

Prove and apply that the sum of the interior angles of a triangle is 180°.

Prove that all points on a perpendicular bisector of a segment are equidistant from the segment endpoints.

Prove that the base angles of an isosceles triangle are congruent.

Prove that the medians of a triangle meet at a point, a point of concurrency. (+)

Prove properties of parallelograms and then apply them.

Prove the properties of rectangles and then apply them.

Prove the properties of rhombi and then apply them.

Prove the properties of squares and then apply them.

Prove properties of kites and trapezoids and apply them (+)

Classify a quadrilateral by its properties.

Identify the conditions necessary to prove that a quadrilateral is a parallelogram.

Resources

Pearson Resources:

3-5, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 5-1, 5-2, 5-4, 6-2, 6-3, 6-4, 6-5, 6-6

Online Resources:

- http://illuminations.nctm.org/Lesson.aspx?id=2469
- http://fivetriangles.blogspot.com/2012/04/paper-folding.html
- http://map.mathshell.org/materials/lessons.php?taskid=212&subpage=concept
- http://mrpiccmath.weebly.com/blog/3-acts-tv-space
- http://fivetriangles.blogspot.com/2012/04/isosceles-triangles.html