

Lesson Plan (Math)

Grade/ Grade Band: 9 th grade Geometry		Topic/Title: 6-2: Properties of Parallelograms	
Brief Class Description (contextual information including number of students, subject, level, IEP/ELL/GT or other special considerations): Mod 1B: This classroom environment is very relaxed. There are 30 students in the class, and there are many friends at tables which makes for productive noise. They feel comfortable joking around and having fun. There is one student who has had behavior problems with other teachers in the past, but he is said to have started new medication that will help this. Mod 3B: This period of students is less confident and needs more guidance than the other class. There are 25 students in this class. There is a group of boys who can get loud, but with nonverbal and verbal communication they will settle.			
Brief Lesson Description (Overview/Abstract): Students will do a discovery activity to find properties of parallelograms, and then apply their knowledge to coordinate geometry and real life.			
Objective(s): I can prove and apply properties of parallelograms in order to solve problems with unknowns.			
Prior Student Knowledge: Students have been introduced to parallelograms but not to their properties.		Possible Preconceptions/Misconceptions: Students may believe the only property of parallelograms is that they have two sets of parallel sides, while that is actually is the definition not a property.	
Common Core Standards: HSG-CO.C.11 - Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.		Standards for Mathematical Practices: Attend to Precision. Look for and make use of structure.	
Required materials: Parallelogram sheet Property explore sheets (A-G) Properties Chart		Safety considerations: N/A	Technology Integration/Needs: Projector
ENGAGE: (30 minutes)(60 minutes left) Task: First, students will take a pre-quiz on quadrilaterals to assess their understanding. Students will be given a handout with a set of quadrilaterals and a definition section on it. They will work with their table groups to figure out which polygons are parallelograms and which ones are not. Then based on the examples they just circled, the groups will come up with a brief definition of what they think a parallelogram is. After 5 minutes, definitions will be shared by using a numbered spinner for the table number.			
Instruction: <i>Teacher instruction</i> Student Answers <i>“I am currently handing out a paper with a bunch of quadrilaterals on it. In your table groups, circle the quadrilaterals that you think are parallelograms and then think about a definition of what a parallelogram could be.”</i> Case 1: All answers shared correct.			

“The parallelograms have two sets parallel sides.”

“They are quadrilaterals.”

“They are convex but not always regular.”

Case 2: Some incorrect answers shared.

“This quadrilateral has two parallel sides (not two sets) so it is a parallelogram.”

“A parallelogram must have some parallel lines.”

Transition: “So now we have some ideas for what a parallelogram could be. Let’s explore those possibilities!”

Instructional Strategies:

Numbered Spinner

Table group work

EXPLORE/EXPLAIN Cycle(s)

EXPLORE:

(15 minutes)(45 minutes left)

Task: Students will discover the properties of parallelograms by analyzing the sides and angles. Each table group will get two copies of a parallelogram while each table gets a different parallelogram. The side, angle, and diagonal measures are all given. Each student will receive a paper with questions on it such as “What do you notice about the angles?” To prompt analysis. Tables will work together for 10 minutes to answer the questions.

Instruction:

“I am handing out three sheets of paper to each table. There are two copies of a parallelogram, and every table gets a different parallelogram; everyone will also get a questions sheet. Using the questions and the parallelogram, work with your teams to figure out the properties of parallelograms. I’ll give you a hint: even though each table has different parallelogram, you all should get the same properties! You have 10 minutes. I will be walking around if you have questions!”

Transition: “Let’s see what table is going to share what they’ve found with us…”

Instructional Strategies:

Discovery Learning

EXPLAIN (STUDENT CENTERED):

(20 minutes)(25 minutes left)

Task: 4 students (picked randomly by a spinner) will share what they observed about the properties of a parallelogram. Then students will be given a handout with the formal theorems stating the properties (from the textbook). We will quickly go over each property and students will ask any questions they have at this time.

Students will be given a worksheet that applies the properties to algebra by finding missing angles and sides and solving for unknowns.

Instruction:

“Table [blank], what did you notice about the measurements of the 4 sides of your parallelogram that you think could relate to other parallelograms?”

Case 1: correct.

"The opposite sides were congruent, so they were the same length."

Case 2: incorrect.

"All 4 sides are not equal."

"The sides added up to #."

"The sides are equal." *"What sides?"*

"Are there any other quadrilaterals that you could think of that have opposite sides congruent?"

Case 1: correct.

"Rectangle."

"Rhombus."

"Square."

Case 2:

"Trapezoid."

"All quadrilaterals."

"All convex quadrilaterals."

"What did you notice about the angles of the parallelogram, table[blank]?"

Case1: correct.

"The opposite angles are congruent."

"The consecutive or adjacent angles are supplementary."

Case 2: incorrect.

"There is nothing similar about the angles."

"All the angles are the same."

"The opposite angles add to 180."

"The adjacent angles are congruent."

Instructional Strategies:

Cold Call

Application

ELABORATE:

(17 minutes) (8 minutes remaining)

Task: Students will get white boards for their tables and apply their knowledge of properties of parallelograms to solve for unknowns and extend to coordinate geometry. Students will have a few seconds to write and show their answers for the first few problems, and then be given a longer period of time for later questions. There is also an extension to figuring out the formula for the area of a parallelogram.

Instruction:

"One person from each table, please get two white boards for your table."

"You have ten seconds to answer the first question!"

"Boards up! What measure did we get?"

"You have twenty seconds to answer this (7th) question!"

"Now, this next question is a preview for what we will be learning next class, I'd like to see if you can figure it out."

"For this coordinates question, use the back of your white board. It has a coordinate plane on it."

"Area of a parallelogram! It's similar to a rectangle. What do we think?"

Transition: "Let's summarize what we've learned."

COGNITIVE CLOSURE

(8 minutes)

Task: Students will turn and talk about three summary questions projected. What are the key characteristics of a parallelogram? How do the characteristics help us solve problems? How could we use the properties of parallelograms in our own lives?

Instruction:

"I'd like you to look at these questions and turn and talk for a minute with your groups about them. Then I will call on a random table!"

"Table [blank], what are some key characteristics of a parallelogram?"

Case 1: Correct characteristics.

"Two sets of parallel lines."

"Diagonals that bisect each other."

"Congruent opposite angles."

"Supplementary adjacent angles."

Case 2: Incorrect answers.

"Two sides that are parallel to each other."

"Diagonals that intersect." *"What else is special about the diagonals?"*

"Congruent adjacent angles."

"Supplementary opposite angles."

"Table [blank], how do the characteristics of a parallelogram help us solve problems?"

Case 1: correct answers.

"We can use the properties and definition of parallelograms to find variables and missing sides or angles."

Case 2: incorrect answers.

"Parallelograms help us solve problems by being math stuff so we can solve math stuff with it."

"Table [blank], how could we use properties of parallelograms in real life?"

"We could use it in construction, building something that is parallelogram shaped."

Instructional Strategies:

Turn and Talk

EVALUATE:

Diagnostic Assessment(s): The drill students do is a review of parallel lines crossed by a transversal, which relates to prove the properties of parallelograms. This drill will help me gauge what students remember about that unit and how to apply that previous knowledge.

Formative Assessment(s): Students complete a handout for the exploration activity, which I could call as an assessment of what they've discovered. Then the white board work allows me to evaluate individual students on their ability to apply what they've learned.

Summative Assessment(s): Chapter 6 Test 4/20/18

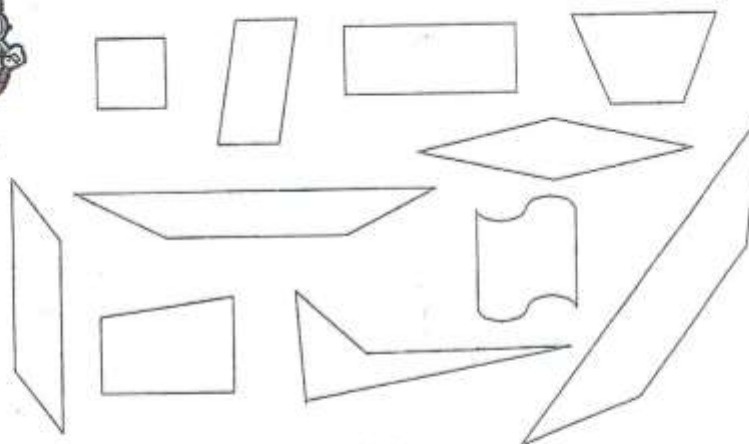
Timing/Pacing Adjustments (Slinky Time): Include a plan for how to adjust instruction if tasks take longer/shorter than anticipated:

If there is more time, the white board work can be extended with multiple area and coordinate geometry problems. (+7 mins)

If there is less time, we will only do one extension white board problem and instead of multiple and then move to a quick cold call summary instead of turn and talk. (-5 mins)

Just the Facts

Circle the quadrilaterals that are parallelograms.



Write your own definition of a parallelogram.



Discovering the Properties of Parallelograms

Directions: In groups, answer the following questions by analyzing your parallelogram. It might help to write in the different side lengths and angle measurements.

1) The measurements of all 4 sides of the parallelogram are given. What do you notice?

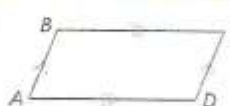
2) Are there any other quadrilaterals that will share this property?

3) What do you notice about the angles of the parallelogram? (hint: think about the properties of angles of two parallel lines cut by a transversal)




4) You will notice that the diagonals of the parallelogram are shown. Is there a relationship? If so, what is it?

Complete the first column of *Properties of Parallelograms*

Theorem 6-2-1 Properties of Parallelograms

THEOREM	HYPOTHESIS	CONCLUSION
If a quadrilateral is a parallelogram, then its opposite sides are congruent. ($\square \rightarrow \text{opp. sides} \cong$)		$\overline{AB} \cong \overline{CD}$ $\overline{BC} \cong \overline{DA}$

Theorems Properties of Parallelograms

THEOREM	HYPOTHESIS	CONCLUSION
6-2-2 If a quadrilateral is a parallelogram, then its opposite angles are congruent. ($\square \rightarrow \text{opp. } \angle \cong$)		$\angle A \cong \angle C$ $\angle B \cong \angle D$
6-2-3 If a quadrilateral is a parallelogram, then its consecutive angles are supplementary. ($\square \rightarrow \text{cons. } \angle \text{ supp.}$)		$m\angle A + m\angle B = 180^\circ$ $m\angle B + m\angle C = 180^\circ$ $m\angle C + m\angle D = 180^\circ$ $m\angle D + m\angle A = 180^\circ$
6-2-4 If a quadrilateral is a parallelogram, then its diagonals bisect each other. ($\square \rightarrow \text{diags. bisect each other}$)		$\overline{AZ} \cong \overline{CZ}$ $\overline{BZ} \cong \overline{DZ}$