

CC Standards: CCSS.Math.Content.7.G.A.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

NCTM Standards:

- precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties;
- draw geometric objects with specified properties, such as side lengths or angle measures;
- use geometric models to represent and explain numerical and algebraic relationships;

Purpose: The idea of this lesson is to build on students' understanding of the properties of quadrilaterals, specifically parallelograms. The lesson focuses on teaching students to use their knowledge of mathematical reasoning to prove the properties of parallelograms are true for any parallelogram.

I. Engagement Block (Launch):

Overview: Teacher will begin by reviewing/discussing what a parallelogram is and the different types of parallelograms. Ask students what are the properties of parallelograms? (3 minutes; 9:05-9:08). The teacher will then ask students to discuss the sufficient conditions for a parallelogram or what is the most basic definition of a parallelogram? (3 minutes; 9:08-9:11). The teacher will model the drawing of a standard parallelogram using the properties and standard definition the students provide to the previous questions. Students will most likely state that the properties of a parallelogram are

1. Two sets of parallel sides
2. Opposite sides are congruent
3. Opposite angles are congruent

Teacher will then use ask students if they all agree that these properties are true for ALL parallelograms. Teacher will then use the students' most basic definition of a parallelogram to draw a parallelogram (10 minutes; 9:11-9:21). Teacher will provide students with a work sheet that lists the properties of parallelograms and ask students to name any that are unfamiliar to them (3 minutes; 9:21-9:24).

Teacher Roles/Behaviors: Modeling, explaining, demonstrating, describing, representing, and checking for understanding.

listening, predicting, observing, taking notes, asking

II. Cooperative Work Block (Exploration Block):

Overview: Discovery and exploration. Teacher will have students get laptops and open up Geogebra. Students will practice making parallelograms using Geogebra. Students will explore what types of parallelograms can be made using the properties of parallelograms (6 minutes; 9:24-9:30).

Students will explore and explain what shapes are made when a property is missing. Teacher will ask students to try to make a parallelogram that

1. Does not have sides that are both parallel and congruent
2. Does not have pairs of opposite congruent sides
3. Does not have diagonals that bisect each other
4. And does not have pairs of opposite congruent angles.

(10 minutes; 9:30-9:40).

Teacher will then talk to students about the Sufficient Conditions for a parallelogram and ask students if they can explain those conditions

- a. One pair of sides is both parallel and congruent, or
- b. Both pairs of opposite sides are congruent, or
- c. The diagonals bisect each other, or
- d. Both pairs of opposite angles are congruent

If students cannot come up with an explanation, the teacher will explain the SCP Theorem. And students will practice creating parallelograms using the sufficient conditions. They will create a parallelogram from scratch using the SPC worksheet. Students will use the worksheet to draw a parallelogram using properties a-d individually and discuss the SPC worksheet (10-15 minutes; 9:40-9:50 or 9:40-9:55).

Teacher Roles/Behaviors: Questions, facilitates, coaches, clarifies, encourages, listens, observes, and assesses.

Student Roles/Behaviors: Problem-solves, analyzes, describes, creates, contrives, explains, questions, and listens.

Back-Up Activity: How Many Parallelograms Can You Make?

III. Summary Block:

Overview: Student and teacher sharing. Students will come together as a whole group to recount their findings and explain what they did, what they discovered, and their thoughts. Students and teacher will review class definitions for new vocabulary in their quadrilateral chart. Teacher will take advantage of any teachable moments and will review the new material (properties of parallelograms and sufficient conditions and any similarities the parallelogram has to any other shapes) that were covered during the lesson. Teacher will also make connections between what

previous lessons and work by asking questions and leading a
-9:55 or 9:55-10:00).

Teacher Roles/Behaviors: Questions, listens, coaches, clarifies, leads discussion, assesses, supports, and encourages student participation.

Student Roles/Behaviors: Leads, explains, analyzes, generalizes, compares, represents, communicates, clarifies, answers questions from teacher and peers. Students will submit questions and comments.

IV. **Application/Extension/Practice Block:**

Overview: Students will apply concrete strategies, operations, and representations to additional problems with or without text. The students will spend some time in class and outside of class (homework) answering problems about parallelograms. Students will be assigned homework problems 1-26 odd from section 7-7 and 1-21 odd for 7-8, and students will be assigned to create a picture on Geobegra using only parallelograms. Students will also be informed they will need to show their work in their homework for 7-7 and 7-8.

Teacher Roles/Behaviors: Introduction, conference, assesses works with students in a group.

Student Roles/Behaviors: Applies new knowledge of properties of shapes, representations or strategies to different problems, developing accuracy and fluency, reviewing and practicing skills

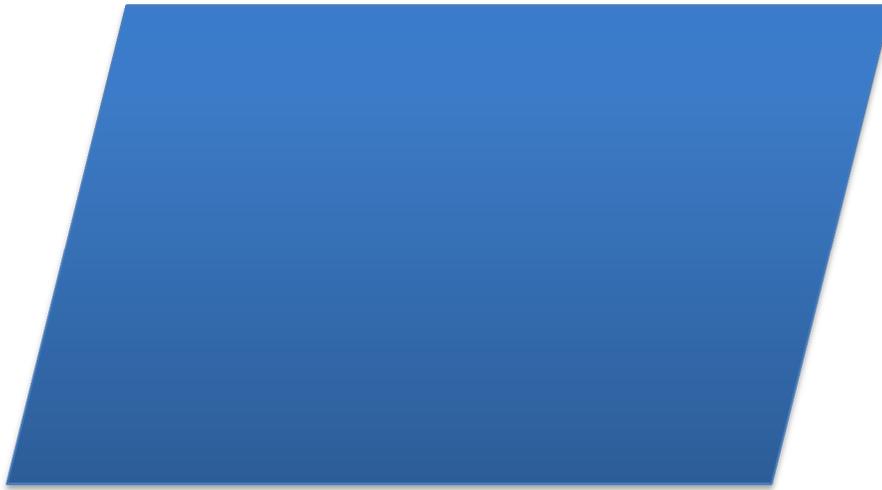
Materials: Homework problems that connect and support students' understanding of the properties of parallelograms. Quadrilateral chart.

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Properties of Parallelograms

- a. Opposite sides are congruent;
- b. Opposite angles are congruent;
- c. The diagonals intersect at their midpoints.



Parallelogram Using Geobegra

- (1) Draw points A and B
- (2) Draw a segment from A to B
- (3) Draw point C
- (4) Draw a segment from B to C.
- (5) Using the PARALLEL LINE TOOL, construct a line parallel to segment AB through point C.
- (6) Using the PARALLEL LINE TOOL, construct a line parallel to segment BC through point A.
- (7) Construct point D where the parallel lines intersect.
- (8) Hide the parallel lines and draw segments from A to D and from C to D.



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picture using only parallelograms.