

June 26

Grade 4 Mathematics Lesson Plan

Date: June 26, 2019

Denenchofu Elem. School, Ohta Ward, Tokyo

Grade 4 Cherry Blossom Team¹

Location: Gymnasium

Teacher: SATOH, Akira

2019 Research Theme:

Elementary Mathematics Department of Ohta Ward Research Group

Designing lessons in which students will make use of mathematical ways of observing and reasoning and deepen their learning.

1 Name of the unit: Let's explore quadrilaterals

2 Goals of the unit

Through activities to examine the positional relationships among lines and the structures of quadrilaterals, students will understand perpendicular and parallel lines and definitions of trapezoids, parallelograms and rhombuses. They will also enrich their ways to observe geometrical figures and spatial sense.

¹ The Cherry Blossom team is one of 4 teams for this unit. It is an advanced group.

3 Assessment standards

	A. Interest, Eagerness, and Attitude	B. Mathematical Way of Thinking	C. Mathematical Skills	D. Knowledge and Understanding
Standards for the Unit	Students can identify perpendicular lines, trapezoids, parallelograms, rhombuses, etc. in their surroundings and actively thinking about the situations where those figures are being used.	Students can identify properties of various quadrilaterals by focusing on the positional relationships of their sides and other structural characteristics. They can grasp the properties of diagonals, integrating their understandings.	Students can draw perpendicular lines, trapezoids, parallelograms and rhombuses.	Students understand the definitions and properties of perpendicular and parallel lines, trapezoids, parallelograms, and rhombuses. Students enrich their spatial sense.
	<ol style="list-style-type: none"> 1. Students are investigating how lines are intersecting by focusing on the angles formed by the lines. 2. Students are trying to classify quadrilaterals by focusing on the number of pairs of parallel sides. 3. Students are attempting tiling activities while making use of what they have learned. 	<ol style="list-style-type: none"> 1. Students are thinking about and able to explain how to draw perpendicular lines by focusing on the right angle on set squares. 2. Students are thinking about and able to explain how to draw parallel lines by focusing on the property of the congruence of corresponding angles. 3. Students identify and explain properties of parallelograms by focusing on the positional relationships and lengths of sides and angle measurements. 4. Students are thinking about and able to explain how to draw a parallelogram by making use of the definition and properties of parallelograms. 5. Students identify and explain properties of rhombuses by focusing on the positional relationships and lengths of sides and angle measurements. 6. Students are thinking about and grasping the relationships among quadrilaterals by focusing on the characteristics of diagonals. 	<ol style="list-style-type: none"> 1. Students can draw perpendicular lines by using set squares. 2. Students can identify and verify parallel lines. 3. Students can draw parallel lines using set squares. 4. Students can draw parallelograms. 5. Students can draw rhombuses. 6. Students can make various quadrilaterals by putting together two congruent triangles. 7. Students can solve problems by applying what they learned in the unit. 	<ol style="list-style-type: none"> 1. Students understand the meaning of perpendicularity. 2. Students understand the meaning of parallelism. 3. Students understand that parallel lines will intersect another line forming the angles of equal measurements and the width between a pair of parallel lines is constant. 4. Students understand how to identify and verify perpendicular or parallel lines using a grid. 5. Students understand the definitions of parallelograms and trapezoids. 6. Students understand the properties of parallelograms. 7. Students understand the definition of diagonals and the characteristics of diagonals in various quadrilaterals. 8. Students understand that the 2 triangles obtained by splitting a parallelogram by a diagonal are congruent.

4 About the Unit

(1) About the topic

According to the new Course of Study (to be implemented starting in the 2020 school year), the contents of this unit are described as follows.

Grade 4 B Geometrical Figures

(1) To provide instruction so that pupils acquire the following items through mathematical activities on plane figures.

A. Acquire the following knowledge and skills.

(a) To understand the relationships such as parallelism and perpendicularity of straight lines.

(b) To get to know parallelograms, rhombuses and trapezoids.

B. Acquire the following abilities to think, make judgments and express themselves.

(a) To examine the way geometrical figures are composed and identify their properties by paying attention to the constituent parts of geometrical figures and their positional relationships, and to reinterpret the previously studied geometrical figures based on those properties.

[Knowledge and skills to be learned in this unit]

(a) Perpendicular and parallel lines

Students are expected to understand the following definitions of perpendicularity and parallelism:

- When 2 lines intersect to form right angles, the two lines are perpendicular to each other.
- When 2 lines are perpendicular to a 3rd line, the 2 lines are parallel to each other.

They will develop this understanding through activities to draw perpendicular and parallel lines using set squares and to investigate perpendicular and parallel relationships in rectangles and squares they have previously learned.

In addition, through activities to investigate the characteristics of parallel lines, they will discover the following properties of parallel lines:

- A pair of parallel lines will never intersect each other.
- The width between two parallel lines is constant no matter where they are measured.

Moreover, through activities to investigate perpendicular lines, students will recognize the difference between right angles and perpendicularity. The aim of instruction is for students to understand that perpendicularity and parallelism are about positional relationships between 2 lines through mathematical activities.

(b) Parallelograms, rhombuses and trapezoids

Previously, students have learned to examine geometrical figures by using the length of sides and angle measurements as the lens for observation. In this unit, students will learn “parallelism” and “perpendicularity” as new lens to examine geometrical figures. They will learn that when a pair of opposite sides of a quadrilateral are parallel, it is a trapezoid, and when there are 2 pairs of parallel sides in a quadrilateral, it is a parallelogram. Through the activity to classify quadrilaterals obtained by overlapping 2 geometrical figures, they will develop the capacity to sort quadrilaterals without being influenced by their orientations and sizes.

By using the length of sides as a lens to observe quadrilaterals, students realize that rhombuses form a class of quadrilaterals. By comparing and contrasting rhombuses to parallelograms,

squares, and rectangles, they will discover similarities and differences among them and deepen their understanding of geometrical figures.

Moreover, through activities to examine the characteristics of diagonals in various quadrilaterals and through tiling activities, students will discover characteristics involving the size of angles.

[Ability to reason, judge, and express oneself to be learned in this unit]

Through activities to examine relationships between two segments (sides) in quadrilaterals, we want to help students understand the special relationships between two lines, perpendicularity and parallelism. We want students will deepen their understanding by engaging in concrete activities such as classifying geometrical figures using pairs of parallel sides as a lens for observation and drawing parallelograms and rhombuses using their properties that have been identified.

In particular, we consider the activity in today's lesson where students create and classify quadrilaterals by overlapping familiar figures as a key experience. We want students to experience activities so that they can reason and judge that infinitely many different geometrical figures can be made by changing the way two geometrical figures are overlapped, and that they can classify quadrilaterals by using parallel sides as a lens for observation. We want them to be able to express those ideas as well.

In addition, we want students to realize that rectangles, squares and rhombuses are all special types of parallelogram when we use the parallel sides as a lens for observation. In this way, students can deepen their understanding of geometrical figures and begin to develop a unified view of quadrilaterals.

Moreover, through the activities to examine the length and positional relationships of diagonals in various quadrilaterals, we want students to be able to identify common characteristics. In this way, students will enhance their capacity to focus on the way quadrilaterals are structured and relationships among the constituent parts of quadrilaterals.

(2) About the students

Students have learned about geometrical figures in previous grades: "rectangles, squares and right triangles" in Grade 2; "isosceles and equilateral triangles" in Grade 3, and "angle measurements" in Grade 4. As structural features of geometrical figures, students have learned about "the number of sides and vertices," "right angles," "length of sides" and "size of angles." Students have also classified triangles and quadrilaterals using a particular viewpoint. In addition, they have learned the definitions of geometrical figures and how to draw them using their definitions and properties.

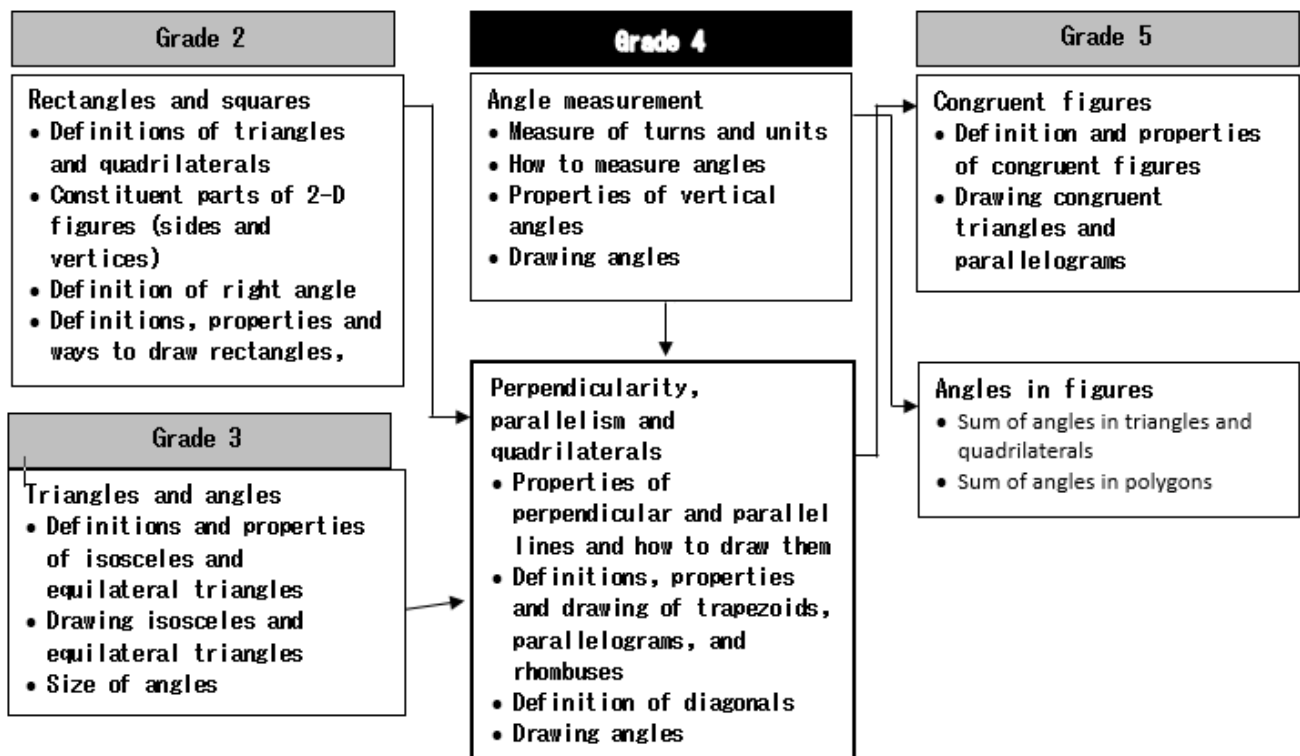
At our school, we administer a readiness test before each unit. Based on the results of the readiness test, and also considering each student's own desire, we organize teams for each unit. The results of the readiness test for the current unit is as follows.

	Purpose of the question			Success rate
①	Students can draw isosceles triangles			79 %
②	Students can measure angles using right angle as a unit			90 %
③	Students know the names and the definitions of rectangles, squares, isosceles triangles and equilateral triangles.			
	Rectangles	Name 91 %	Definition 26 %	
	Squares	Name 75 %	Definition 25 %	
	Isosceles triangle	Name 91 %	Definition 81 %	
	Equilateral triangle	Name 91 %	Definition 80 %	
④	Students can identify the triangles they can make by using 2 set squares (equilateral triangle and isosceles triangle).			81 %
⑤	Students understand the congruence of vertical angles.			89 %

From the readiness test, we can see that many students can visually identify rectangles and squares, but not many students understand their definitions. In addition, students who indicated that they enjoyed the study of geometrical figures gave the reasons such as “I enjoy drawing and making figures myself,” and “geometrical figures are composed of many figures and I enjoy thinking about them.” On the other hand, students who indicated that they did not like the study of geometrical figures gave the reasons such as “there are many different ways of reasoning, and I can’t keep them straight,” and “I don’t understand how to draw specific figures.”

Based on the results of the readiness test, it is decided to design the lessons in this unit so that students can first understand the definitions of geometrical figures based on mathematical activities that allow them to experience the definitions. Then, based on the definitions they understood, they will think about ways to draw those figures. Through these activities, even those students who do not like the study of geometrical figures may discover commonalities among various ways of reasoning, and they can enjoy drawing activities in which the rationale for each step of drawing is made clear.

5 Scope and sequence



6 Organization of the unit and evaluation plan

		Cherry Blossom	Sunflower	Cosmos	
	Goals	Learning activity			Evaluation standards
1	Motivate students to examine quadrilaterals by focusing on structural components of the figures.	Let's make different quadrilaterals and find similarities and differences among them. <ul style="list-style-type: none"> • Draw quadrilaterals by connecting dots. • Discuss different ways lines are intersecting each other and different quadrilaterals formed by intersecting lines. Students will become interested in plane figures. • Investigate different ways two lines may intersect each other. • Know the definition of perpendicularity. 			[A] In addition to the length of sides and the size of angles, students are examining quadrilaterals using the relationships of sides as a lens. [A-1] Students are examining the ways lines are intersecting by focusing on the angles formed. [D-1] Students understand the definition of perpendicularity.
2	Through the activities to examine the ways 2 lines intersect, students will know the meaning of perpendicularity and be able to identify and justify perpendicular lines. Students will be able to draw perpendicular lines using set squares.	Let's think about ways to draw perpendicular lines using set squares. <ul style="list-style-type: none"> • Think about ways to draw perpendicular lines using set squares based on the definition of perpendicular lines. • Draw perpendicular lines. 	Let's think about ways to draw perpendicular lines using set squares. <ul style="list-style-type: none"> • Think about ways to draw perpendicular lines using set squares based on the definition of perpendicular lines. • Draw perpendicular lines. 	Let's think about ways to draw perpendicular lines using set squares. <ul style="list-style-type: none"> • Given a line, think about ways to draw a line that will be perpendicular to the given. • Think about ways to draw perpendicular lines using set squares. • Draw perpendicular lines. 	[B-1] Students are thinking about and able to explain how to draw perpendicular lines by focusing on the right angle on set squares. [C-1] Students can draw perpendicular lines by using set squares.
3	Through the activities to examine the ways 2 lines intersect, students will know the meaning of parallelism and be able to identify and justify parallel lines.	Let's think about ways to identify parallel lines. <ul style="list-style-type: none"> • Examine the way lines are arranged. • Know the definition of parallelism. • Identify and justify parallel lines. • Look for perpendicular and parallel sides in rectangles. • Deepen the understanding of parallelism by comparing and contrasting various lines, including curves that are equally spaced from each other. 	Let's think about ways to identify parallel lines. <ul style="list-style-type: none"> • Examine the way lines are arranged. • Know the definition of parallelism. • Identify and justify parallel lines. • Look for perpendicular and parallel sides in rectangles. 	Let's think about ways to identify parallel lines. <ul style="list-style-type: none"> • Examine the way lines are arranged. • Know the definition of parallelism. • Using a given pair of parallel lines as the point of reference, distinguish and justify parallel lines from those that are not. • Look for perpendicular and parallel sides in rectangles. 	[C-2] Students can identify and verify parallel lines. [D-2] Students understand the meaning of parallelism.

4	Students will understand properties of parallel lines such as they will intersect another line forming congruent angles and their width is constant.	<div data-bbox="443 208 1345 264" data-label="Text"> <p>Let's examine properties of parallel lines.</p> </div> <div data-bbox="443 275 1201 1227" data-label="List-Group"> <ul style="list-style-type: none"> • Explain that parallel lines will intersect a line forming congruent angles based on their knowledge of the congruence of vertical angles and congruence of corresponding angles. They can also explain that parallel lines will not intersect each other no matter how far they are extended. • Examine angles formed by parallel lines and another line. • Examine the width of parallel lines. • Summarize that the distance between a pair of parallel lines is constant. • Deepen their understanding of parallelism by knowing we do not call curves parallel even if the distance between them is constant. • Examine angles formed by parallel lines and another line. • Examine the width of parallel lines. • Summarize that the distance between a pair of parallel lines is constant. • Deepen their understanding of parallelism by knowing we do not call curves parallel even if the distance between them is constant. • Using parallel and perpendicular lines found in the lines and grids in their notebooks, examine angles formed by lines and the width of parallel lines.. • Summarize that the distance between a pair of parallel lines is constant. • Deepen their understanding of parallelism by knowing we do not call curves parallel even if the distance between them is constant. </div> <div data-bbox="1209 275 1447 1227" data-label="Text"> <p>[D-3] Students understand that parallel lines will intersect another line forming the angles of equal measurements and the width between a pair of parallel lines is constant.</p> </div>	
5	Students can draw parallel lines using set squares.	<div data-bbox="443 1240 1345 1296" data-label="Text"> <p>Let's think about ways to draw parallel lines using set squares</p> </div> <div data-bbox="443 1308 1201 1998" data-label="List-Group"> <ul style="list-style-type: none"> • Explain the way to draw parallel lines based on the congruence of corresponding angles. • Think about ways to draw parallel lines using set squares. • Draw parallel lines. • Examine the relationships of sides in rectangles and squares and identify that the opposite sides are parallel and adjacent sides are perpendicular. • Explain the way to draw parallel lines based on the congruence of corresponding angles. • Think about ways to draw parallel lines using set squares. • Draw parallel lines. • Examine the relationships of sides in rectangles and squares and identify that the opposite sides are parallel and adjacent sides are perpendicular. • Given a line, think about ways to draw a second line that will be parallel to the given. • Think about ways to draw parallel lines using set squares. • Draw parallel lines. • Examine the relationships of sides in rectangles and squares and identify that the opposite sides are parallel and adjacent sides are perpendicular. </div> <div data-bbox="1209 1308 1447 1998" data-label="Text"> <p>[B-2] Students are thinking about and able to explain how to draw parallel lines by focusing on the property of the congruence of corresponding angles. [C-3] Students can draw parallel lines using set squares.</p> </div>	

6	Students will understand perpendicular and parallel lines in on grid papers.	Let's think about ways to identify perpendicular and parallel lines when they are drawn on a grid.			<ul style="list-style-type: none"> Think about ways to identify perpendicular and parallel lines on a grid based on the fact that you can draw a line with a specific slant when you move ○ spaces vertically and □ spaces horizontally. 	<ul style="list-style-type: none"> Think about ways to identify perpendicular and parallel lines on a grid. 	<ul style="list-style-type: none"> Think about ways to identify perpendicular and parallel lines on a grid. 	[D-4] Students understand how to identify and verify perpendicular or parallel lines using a grid.
7	[Today's Lesson] Through the activity of classifying quadrilaterals, students will understand the definitions of trapezoids and parallelograms.	Let's examine how many different kinds of quadrilaterals we can make by overlapping two figures.			<ul style="list-style-type: none"> Given various figures classify quadrilaterals. Know the definitions of trapezoids and parallelograms. Deepen their understanding of parallelograms by identifying common features among rectangles, squares and parallelograms. 	<ul style="list-style-type: none"> Given various figures classify quadrilaterals. Know the definitions of trapezoids and parallelograms. Deepen their understanding of parallelograms by identifying common features among rectangles, squares and parallelograms. 	<ul style="list-style-type: none"> After confirming that we are classifying figures using parallel sides as a lens, classify quadrilaterals. Know the definitions of trapezoids and parallelograms. Deepen their understanding of parallelograms by identifying common features among rectangles, squares and parallelograms. 	[A-2] Students are trying to classify quadrilaterals by focusing on the number of pairs of parallel sides. [D-5] Students understand the definitions of parallelograms and trapezoids.
8	Students will understand the properties of parallelograms.	Let's examine properties of parallelograms.			<ul style="list-style-type: none"> Draw trapezoids and parallelograms using grid lines or given parallel lines. Look for the properties of parallelograms by investigating lengths of sides and angle measurements. 	<ul style="list-style-type: none"> Draw trapezoids and parallelograms using grid lines or given parallel lines. Look for the properties of parallelograms by investigating lengths of sides and angle measurements. 	<ul style="list-style-type: none"> Draw trapezoids and parallelograms using grid lines or given parallel lines. Look for the properties of parallelograms by investigating lengths of sides and angle measurements. 	[B-3] Students identify and explain properties of parallelograms by focusing on the positional relationships and lengths of sides and angle measurements. [D-6] Students understand the properties of parallelograms.

9	Students can draw parallelograms.	Let's think about ways to draw parallelograms.				[B-4] Students are thinking about and able to explain how to draw a parallelogram by making use of the definition and properties of parallelograms.
		<ul style="list-style-type: none">• Think about ways to draw parallelograms.• Draw parallelograms by making use of the definition and the properties of parallelograms.	<ul style="list-style-type: none">• Think about ways to draw parallelograms.• Draw parallelograms by making use of the definition and the properties of parallelograms.	<ul style="list-style-type: none">• Think about ways to draw parallelograms.• Draw parallelograms by making use of the definition and the properties of parallelograms.		
10	Students can draw the parallelogram whose length of sides and an angle measurement are given.	Let's draw a particular parallelogram.				
		<ul style="list-style-type: none">• Tackle an application problem.				
11	Students will understand the definition and properties of rhombuses. They will be able to draw rhombuses.	Let's think about ways to draw a rhombus using the properties of rhombuses.				[B-5] Students identify and explain properties of rhombuses by focusing on the positional relationships and lengths of sides and angle measurements. [C-5] 8. Students can draw rhombuses.
		<ul style="list-style-type: none">• learning on drawing various geometrical figures, realize that to draw a particular quadrilateral, we need to make use of its properties.• Know the definition of rhombuses.• Summarize the properties of rhombuses.• Draw rhombuses.• Deepen the understanding of rhombuses by examining common characteristics between rhombuses and squares.	<ul style="list-style-type: none">• definition of rhombuses.• Summarize the properties of rhombuses.• Draw rhombuses.• Deepen the understanding of rhombuses by examining common characteristics between rhombuses and squares.	<ul style="list-style-type: none">• definition of rhombuses.• Summarize the properties of rhombuses.• Draw rhombuses.• Deepen the understanding of rhombuses by examining common characteristics between rhombuses and squares.		
12	Students will deepen their understanding of the contents in the unit through mathematical activities, and they become more interested in quadrilaterals.	Let's create tiling patterns using quadrilaterals and find patterns.				[A-3] Students are attempting tiling activities while making use of what they have learned.
		<ul style="list-style-type: none">• Deepen their understanding of 2-D figures through tiling activities using quadrilaterals.• Investigate if it is possible to tile the plane using quadrilaterals other than parallelograms. Think about why it is possible to tile the plane using any quadrilaterals.	<ul style="list-style-type: none">• Deepen their understanding of 2-D figures through tiling activities using quadrilaterals.	<ul style="list-style-type: none">• Deepen their understanding of 2-D figures through tiling activities using quadrilaterals.		

13	Students will understand the definition of diagonals and characteristics of diagonals of various quadrilaterals.	<div>Let's examine diagonals of various quadrilaterals and find patterns.</div> <ul style="list-style-type: none"> Examine the characteristics of segments connecting 2 vertices of various quadrilaterals. Understand the definition of diagonals. Summarize the characteristics of diagonals of various quadrilaterals. Deepen their understanding of diagonals by examining the characteristics of diagonals in isosceles trapezoids and kites. 			<p>[B-6] Students are thinking about and grasping the relationships among quadrilaterals by focusing on the characteristics of diagonals.</p> <p>[D-7] Students understand the definition of diagonals and the characteristics of diagonals in various quadrilaterals.</p>
14	Students will know that triangles obtained by cutting a rectangle, parallelogram, and rhombus are congruent. They will be able to make various quadrilaterals using this knowledge.	<div>Let's make various figures by cutting quadrilaterals along a diagonal.</div> <ul style="list-style-type: none"> Examine the two triangles obtained by cutting a rectangle, parallelogram, and rhombus along a diagonal. Make various quadrilaterals combining the these triangles. Compare and contrast quadrilaterals they created to think about what properties of the quadrilaterals are being used and share their observations. 			<p>[C-6] Students can make various quadrilaterals by putting together two congruent triangles.</p> <p>[D-8] Students understand that the 2 triangles obtained by splitting a parallelogram by a diagonal are congruent.</p>
15	Students will be able to solve problems by making use of what they learned.	<ul style="list-style-type: none"> Complete problems in "Power Builder" and "Mastery Problems." 			<p>[C-7] Students can solve problems by applying what they learned in the unit.</p>
16	Students will make sure they have mastered skills learned in the unit and consolidate their understanding.	<ul style="list-style-type: none"> Tackle problems in a worksheet. 			

7 About the lesson (Lesson #7 of 16)

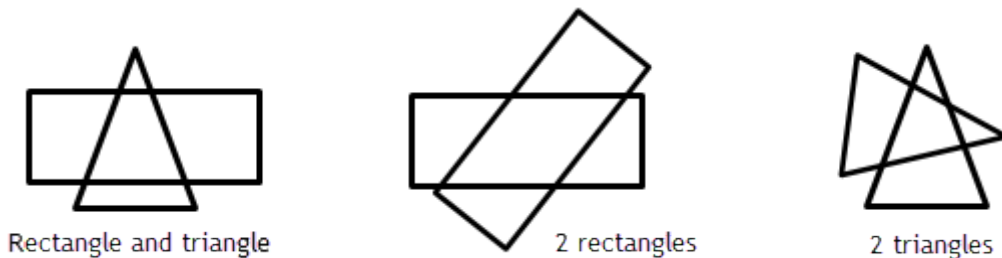
(1) Goal of the lesson

Through the activity of classifying quadrilaterals, students will understand the definitions of trapezoids and parallelograms.

(2) Strategies to address research theme

1 Ideas related to the design of the instructional materials

We want students to make use of the structures of the basic geometric figures and their properties they have previously learned as they deepen their learning processes. To support that aim, we decided to set up an activity in which students will manipulate geometric figures that they have already learned in today's lesson. When students generate and classify new geometric figures on their own while paying attention to the constituent parts of the new figures, they are likely to notice that some quadrilaterals are members of the same group when they are viewed using parallel sides as a lens even if the lengths of sides or angle measurements are different.



2 Students who are using mathematical ways of observing and reasoning in this lesson

[Mathematical ways of observation] --- Students are trying to classify quadrilaterals by focusing on one of the structural components of geometrical figures, positional relationships of sides.

[Mathematical ways of reasoning] --- Students are classifying quadrilaterals using previously learned knowledge of parallelism and perpendicularity, and they are able to integrate their knowledge and understand that rectangles and squares are special types of parallelogram.

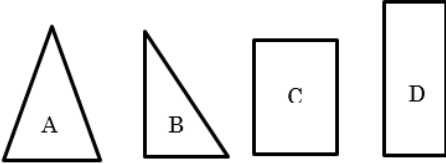
3 Strategies to deepen students' learning

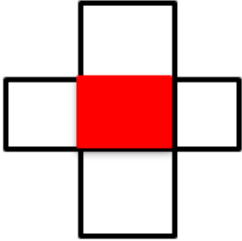
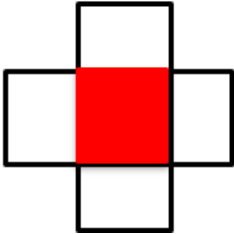

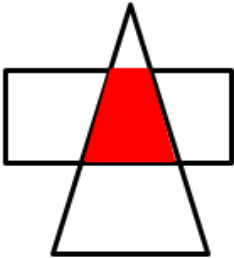
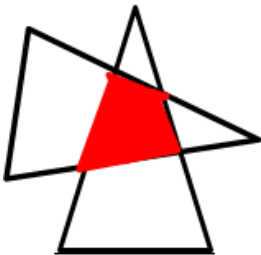
[Whole class discussion] --- To help students deepen their understanding, groups will be asked to share only a part of their ideas so that other students can explain how those groups might have completed their solution.

[Summarizing] --- By looking back on various lenses through which we classified quadrilaterals, students can define parallelograms and trapezoids using the new lens of parallel sides.

[Reflection] --- By having students post the quadrilaterals they created on the whiteboard based on the classification criterion, help students able to classify quadrilaterals based on the positional relationships of sides without being distracted by the orientations and sizes of the figures.

(3) Flow of the lesson

	Learning activity/Content	Instructional points of consideration ○ Support ◆ Evaluation
Grasping the problem/Plan 5 minutes	<p>1 Reflecting on the previous lesson</p> <p>T: What are these shapes? (Show A and B) C: Isosceles triangle. T: How do you know it is an isosceles triangle? C: There are 2 sides that are equal length. C: B is a right triangle because there is a right angle. T: Even though they have different characteristics, they are both triangles, aren't they? T: What are these shapes? (Show C and D) C: Rectangle. C: We can't decide unless we can measure. C: If all 4 angles are right angles, it is a rectangle. C: Opposite sides are parallel and adjacent sides are perpendicular, aren't they?</p> <p>T: I'm going to overlap a rectangle and a triangle. What kind of figures do you think we will get? C: I think it will be a quadrilateral. T: OK, let me show you. C: It's a quadrilateral. C: I think we can make other figures if use different combinations of figures. C: I think we can get different figures even with the same set of figures if we change their angles.</p> <div style="border: 1px solid green; padding: 10px; margin-top: 20px;"> <p>[Goal]</p> <p>Let's make different quadrilaterals by overlapping 2 geometric figures.</p> </div>	<p>○ Reflecting on the definitions and properties of perpendicular and parallel lines students learned in prior lessons.</p> <p>○ Show 2 non-congruent triangles and 2 non-congruent rectangles.</p> <div style="text-align: center; margin: 20px 0;">  </div> <p>○ Teacher will show that the angles are right angles and confirm they are rectangles.</p> <p>○ Remind students that there are 2 pairs of parallel sides in a rectangle so that they may be able to use the characteristics as they sort figures they will create.</p> <p>○ Emphasize that "to classify" means to organize figures using one specific characteristics. There are parallel sides → Yes or No!</p>

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Independent problem solving 7 minutes</p>	<p>2 Investigate what quadrilaterals can be made by overlapping geometric figures, and record the findings in own notebooks</p> <p>C: A rectangle by overlapping a small rectangle with a large rectangle</p>  <p>C: A square by overlapping 2 rectangles (both large or both small)</p>  <p>C: A parallelogram by overlapping 2 rectangles</p>  <p>C: A trapezoid by overlapping a rectangle and a triangle</p>  <p>C: A general quadrilateral by overlapping 2 triangles</p> 	<ul style="list-style-type: none"> ○ Distribute small and large rectangles and triangles (each with 2 copies, one made with laminated colored paper and the other with laminated tracing paper. ○ Instruct students to use the one made with the tracing paper on top to make quadrilaterals. ○ Have students write their name on the quadrilaterals they created.
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<p>Sharing and discussion 23 minutes</p>	<p>3 Think about ways to classify in groups (10 minutes)</p> <p>T: What kinds of quadrilaterals did you make? Let's share your quadrilaterals in groups.</p> <p>C: I made a rectangle using a small rectangle and a large rectangle.</p> <p>C: I made a square using 2 small rectangles.</p> <p>C: Using 2 large rectangles will also make a square.</p> <p>C: The length of sides are different, they are in the same group.</p> <p>T: I heard some groups are saying figures are in "the same group." Did you all find some figures that appear to be in the same group?</p> <p>C: I think there are different ways to groups these figures.</p> <p>T: To classify figures, we need to have a theme, don't we? What kind of characteristics have we used to classify figures?</p> <p>C: Length of sides.</p> <p>C: We also use the size of angles.</p> <p>C: We learned about right triangles and isosceles triangles. I think the rectangles are another example.</p> <p>C: We also learned about perpendicular and parallel lines.</p> <p>T: Let's classify the figures you made by using some of the characteristics of geometrical figures.</p> <p>C: It is difficult to find the figures with the same length sides.</p> <p>C: Some of them have right angles and others don't.</p> <p>C: If you turn one of the figures a bit, we get a slanted quadrilateral (parallelogram).</p> <p>C: With a triangle and a rectangle, you get a shape like a foot stool.</p> <p>C: When you overlap two triangles, it is just a quadrilateral.</p> <p>C: Even if the size of figures we use are different, if we use the same kinds of figures, the quadrilaterals we get look like each other.</p> <p>C: How can we classify them?</p> <p>C: Length of sides and the overall sizes are all different, aren't they?</p> <p>C: I wonder if we can use perpendicular or parallel sides.</p> <p>C: There are 2 pairs of parallel sides in rectangles, squares and parallelograms.</p> <p>C: In rectangles and squares, there are right angles.</p> <p>C: The figure that looks like a foot stool has only a pair of parallel sides.</p> <p>C: When we overlap two triangles, we get a quadrilateral with no pair of parallel sides.</p> <p>C: I think we can make 5 different kinds of quadrilaterals.</p>	<p>○ By using students' own idea of "the same group," we encourage students to classify figures with their own initiative.</p> <p>○ Have students classify figures using the structural components they have learned previously: length of sides, size of angles, parallelism, and perpendicularity.</p> <p>○ If no student raises the possibility of using perpendicular and parallel sides, stop the class, and confirm that length of sides and angle sizes are not appropriate lens to use because we have quadrilaterals of with different sizes.</p> <p>○ Have students record what they used as the lens to classify and what they notice in their notebooks.</p> <p>◆ Students are trying to classify quadrilaterals by focusing on the number of pairs of parallel sides. [A-2] (From students' comments and their notebooks)</p>
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	<p>4 Whole class discussion (15 minutes)</p> <p>T: What kinds of figures did you get by overlapping two figures? C: We made rectangles. C: We made 3 different rectangles. C: We also made squares and a slanted quadrilateral (parallelogram). T: Could you actually show us how you made a slanted quadrilateral? C: (Just demonstrate) Overlap two rectangles, then turn one of them. C: I got it. It was at first a rectangle, but as one rectangle is turned, it became a slanted quadrilateral (parallelogram). C: That's because the size of angles change. C: You get a square only if we overlap two rectangles that are the same. C: That's because all four sides must be equal.</p> <p>T: There is something common among the three quadrilaterals you just shared with us. Some groups used it to classify their quadrilaterals. What is it? C: There are 2 pairs of parallel sides. C: Even when one rectangle is turned, there are always 2 pairs of parallel sides. C: I think rectangles, squares and slanted quadrilaterals (parallelograms) are all in the same group. C: We have to use two rectangles. C: I wonder why we cannot make them using other combinations. C: I think the important point is how many pairs of parallel sides the original figures have.</p> <p>T: Did anyone make other types of quadrilaterals? C: We made a figure that looked like a step stool (trapezoid). T: Can you show us how you made it? C: (Demonstrate) This part is the quadrilateral that looks like a step stool. C: Even when we turn one of the figures, the quadrilateral looks similar. C: This figure has only one pair of parallel side.</p> <p>C: We made another kind. C: We made an irregular quadrilateral. C: We overlapped two triangles. T: Can you show us? C: There is no parallel sides even when we turn one of the figures. C: Even though the figures look all different, we made 5 kinds of quadrilaterals. T: Even though they looked different, when we classify them using parallel and perpendicular sides, we made 5 different quadrilaterals.</p>	<p>○ Allow different students to share instead of one student sharing all types he/she made. This way, help all students develop an understanding.</p> <p>○ If time allows, discuss classifications that used the existence of right angles or equal length sides.</p> <p>○ General quadrilaterals obtained by two triangles will be discussed last.</p> <p>○ If students say ~ and ~ are in the same group, acknowledge the observation. (For example, rectangles and parallelograms are in the same group.) Developing a unified perspective.</p>
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- Have students use drawings and words to summarize today's learning. (Note taking, 5 minutes)

8 Board writing plan

