

## Rich Mathematical Task – Grade 7 – *A Walk in the Park*

### Task Overview/Description/Purpose:

- The purpose of this task is to deepen understanding of properties of quadrilaterals.
- In this task, students will use their knowledge of properties of parallelograms (side lengths and diagonals) to determine the shortest path to travel to multiple locations on the map.

### Standards Alignment: Strand – *Number and Number Sense*

**Primary SOL:** 7.6ab The student will compare and contrast quadrilaterals based on their properties; and determine unknown side lengths or angle measures of quadrilaterals.

**Related SOL (within or across grade levels/courses):** 5.8a, 6.5c, 6.7b, 7.2

### Learning Intention(s):

- **Content** - I am learning to use properties of quadrilaterals to determine an unknown side length in a quadrilateral.
- **Language** - I am learning to use mathematics vocabulary when communicating my thinking about parallelograms.
- **Social** - I am learning to actively listen to my peers to make connections between our work.

### Success Criteria (Evidence of Student Learning):

- I can determine an unknown side length in a parallelogram given the perimeter and length of one side.
- I can use properties of parallelograms to solve a practical problem.
- I can explain the process used to determine missing values in a parallelogram.
- I can justify why my route is the shortest using mathematics vocabulary.
- I can communicate how my work connects to the work of my peers.

### Mathematics Process Goals

Problem Solving	<ul style="list-style-type: none"> <li>• Students will apply their knowledge of properties of parallelograms to determine the shortest path for Paul to take. Their problem-solving strategy may include drawing a picture, making a table, and/or writing expressions.</li> </ul>
Communication and Reasoning	<ul style="list-style-type: none"> <li>• Students will justify verbally and in writing using the vocabulary of characteristics of parallelograms.</li> <li>• Using reasoning, they will defend their claim that their route is the shortest route.</li> </ul>
Connections and Representations	<ul style="list-style-type: none"> <li>• Students will build upon prior knowledge of perimeter as it relates to the lengths of each side of the parallelogram and connect it to planning a route in a practical scenario.</li> <li>• They will represent their ideas using visual, symbolic, and verbal representations.</li> </ul>

### Task Pre-Planning

**Approximate Length/Time Frame:** 45 minutes

**Grouping of Students:** In this task, students will work independently with structured times to gather clarifying information from peers.

Task Pre-Planning	
<p><b>Materials and Technology:</b></p> <ul style="list-style-type: none"> <li>• Blank paper</li> <li>• AngLegs or Exploragons (Not necessary, but could be beneficial especially for students who are tactile or visual learners)</li> </ul>	<p><b>Vocabulary:</b></p> <ul style="list-style-type: none"> <li>• Parallelogram</li> <li>• Quadrilateral</li> <li>• Congruent</li> <li>• Opposite sides</li> <li>• Diagonals</li> <li>• Bisect</li> <li>• Side length</li> <li>• Perimeter</li> </ul>
<p><b>Anticipate Responses:</b> See the Planning for Mathematical Discourse Chart (columns 1-3).</p>	
Task Implementation (Before)	
<p><b>Task Launch:</b></p> <ul style="list-style-type: none"> <li>• Access prior knowledge by asking students if they have ever had to plan a trip where they had to stop at different locations. What was their strategy for planning this trip? Would they want to take the longest route or shortest route if it were raining out?</li> <li>• To help students make sense of the task, do a “Three Reads” protocol of the task. <ul style="list-style-type: none"> <li>○ Show students a version of the task without the question.</li> <li>○ Read the task to the students. Students should follow along and circle any words that are confusing to them. Have a class discussion about any words that students circled to ensure they all know what the words in the task mean.</li> <li>○ Read the task a second time to students. Students should follow along and underline any important information.</li> <li>○ Read the task a third time to students. Ask students what questions could be asked given the information provided in the task. After taking some suggestions, reveal the question.</li> </ul> </li> <li>• Have students read the success criteria so that they are aware of the expectations for solving the task.</li> </ul>	
Task Implementation (During)	
<p><b>Directions for Supporting Implementation of the Task</b></p> <ul style="list-style-type: none"> <li>• Monitor – The teacher will observe students as they work independently on the task. The teacher will engage with students by asking assessing or advancing questions as necessary (see attached <i>Question Matrix</i>).</li> <li>• Select – The teacher will select students to share their work with the class that will advance the mathematical ideas of all students and support student learning.</li> <li>• Sequence – The teacher will select 2-3 student strategies to share with the whole group. One suggestion is to look for one common misconception and two correct responses to share.</li> <li>• Connect – The teacher will consider ways to facilitate connections between different student representations.</li> </ul>	
<p><b>Suggestions For Additional Student Support</b></p> <ul style="list-style-type: none"> <li>• Question students, in both assessing and advancing formats, to help students refine their strategies.</li> <li>• For students with motor processing difficulties, allow them to communicate their reasoning in other ways such as video recording or typing answers.</li> <li>• For students who need academic language support, consider the use of a visual word wall or reference sheet for students to use identifying perimeter, parallelogram, diagonal, and bisector.</li> <li>•</li> </ul>	

- For students who need more support in justifying their thinking, you may choose to provide them with the sentence frames below.
  - The path Paul should take is...
  - He should take this path because...
  - First, I... Then, I...
  - I know my path is the shortest route because...
- For English learners with first language literacy, try to provide the prompt in their home language.
- For students who have difficulty drawing figures, give them the image with diagonals drawn in (see possible graphic organizers).
- Provide multiple images with the diagonals drawn in for students to draw the different pathways (see possible graphic organizers).
- Provide a blank table for students to organize their thinking (see possible graphic organizers).

### **Task Implementation (After) 20 minutes**

#### **Connecting Student Responses (From Anticipating Student Response Chart) and Closure of the Task:**

- Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion. Some possible big mathematical ideas to highlight could include:
  - Common misconceptions about diagonals of parallelograms
  - Ways of organizing information: table, organized list, sequence
- Connect different students' responses and connect the responses to the key mathematical ideas to bring closure to the task. Possible questions and sentence frames to connect student strategies:
  - How are these strategies alike? How are they different?
  - Where do you see \_\_\_\_\_'s representation in \_\_\_\_\_'s work?
  - Why is this important?
- Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion. Some possible ways to do this are to-
  - Assign roles like timekeeper, task master, material fetcher, and recorder of strategies to each member of the group.
  - Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion. A possible way to do this is to use "Snowball" in the middle of the task to have students get new ideas/refine their thinking. In groups of 3-5, have students share their ideas related to the task. What strategies are they using? How are they showing their thinking? Give each group 3-5 minutes to share (roughly 1 minute per student). Then have students form a new group of 3-5. They should not be with any of the same people. Repeat this process of sharing again. "Snowball" is a good way to promote discourse as well as help all students generate and refine strategies for approaching the task.

#### **Teacher Reflection About Student Learning:**

- Teacher should use the chart on the next page with the anticipated student solutions to monitor which students are using each strategy as well as record any additional strategies encountered. The sequence of tasks will inform what will come next in instruction to further student ideas and thinking. Form small groups based on common strategies to address misconceptions that are not addressed in the class debrief.
- Information gathered from the task rubric could identify small groups for later instruction, identifying specific students to partner with one another, and/or identifying students who need more teacher modeling and think alouds.

## Planning for Mathematical Discourse

Mathematical Task: A Walk in the Park

Content Standard(s): 7.6ab

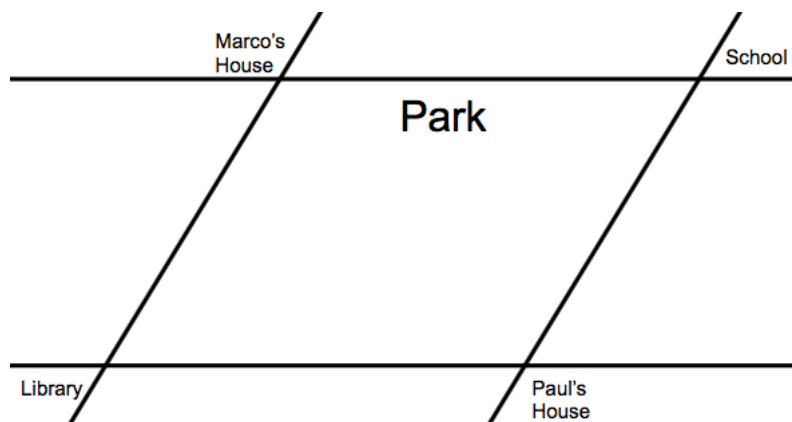
<b>Anticipated Student Response/Strategy</b> <i>Provide examples of possible correct student responses along with examples of student errors/misconceptions</i>	<b>Assessing Questions</b> <i>Teacher questioning that allows student to explain and clarify thinking</i>	<b>Advancing Questions</b> <i>Teacher questioning that moves thinking forward</i>	<b>List of Students Providing Response</b> <i>Who? Which students used this strategy?</i>	<b>Discussion Order - sequencing student responses</b> <ul style="list-style-type: none"> <li>• <i>Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion</i></li> <li>• <i>Connect different students' responses and connect the responses to the key mathematical ideas</i></li> <li>• <i>Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion</i></li> </ul>
<b>Anticipated Student Response:</b> The student is having difficulty starting the task.	<ul style="list-style-type: none"> <li>• What is the question asking you?</li> <li>• What information do you have?</li> <li>• What do you notice?</li> </ul>	<ul style="list-style-type: none"> <li>• Can you draw a possible path that Paul may take?</li> </ul>		
<b>Anticipated Student Response:</b> The student does not bisect the diagonal lengths.	<ul style="list-style-type: none"> <li>• What do you know about the diagonals of a parallelogram?</li> <li>• What happens when you bisect a line?</li> </ul>	<ul style="list-style-type: none"> <li>• What are all of the different ways that Paul can get from the library to his house?</li> </ul>		
<b>Anticipated Student Response:</b> The student finds an alternate route that is not the shortest.	<ul style="list-style-type: none"> <li>• Tell me about your strategy.</li> <li>• Convince me that you found the shortest route.</li> <li>• How confident are you in your answer?</li> </ul>	<ul style="list-style-type: none"> <li>• Can you try another way to help you justify that your route is the shortest?</li> </ul>		
<b>Anticipated Student Response:</b> The student finds the shortest route.	<ul style="list-style-type: none"> <li>• Tell me about your strategy.</li> <li>• Convince me that you found the shortest route.</li> <li>• How confident are you in your answer?</li> </ul>	<ul style="list-style-type: none"> <li>• Can you try another way to help you justify that your route is the shortest?</li> </ul>		

## A Walk in the Park

The distance around a parallelogram park is 324 yards.

- Paul's house and Marco's house are on opposite corners of the park. There is a 57-yard sidewalk that directly connects these two houses.
- The school and the library are also on opposite corners of the park. There is a 150-yard sidewalk that directly connects these two locations.
- The distance between Marco's house and the school is 86 yards, however this road is closed for construction and unpassable. The only way to get from Marco's to the school is to walk through the park.

It has been raining for a few days, so Paul can only walk on the pathways or roads. Paul first walks to school. After school, he must go to the library and Marco's house before returning home. What is the shortest route Paul can take? Justify how you know it is the shortest route.



How much further did he have to walk because the road was closed?

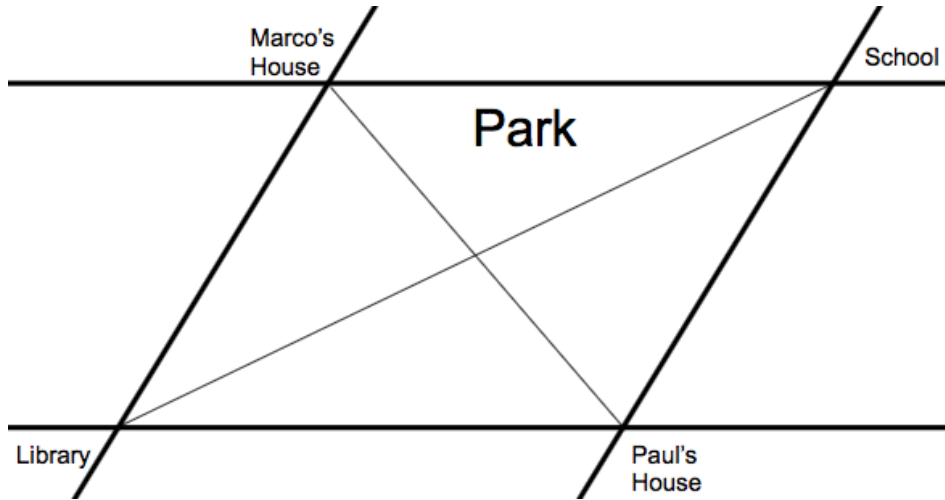
## Rich Mathematical Task Rubric

	Advanced	Proficient	Developing	Emerging
<b>Mathematical Understanding</b>	<p>Proficient Plus:</p> <ul style="list-style-type: none"> <li>Uses relationships among mathematical concepts or makes mathematical generalizations</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates an understanding of concepts and skills associated with task</li> <li>Applies mathematical concepts and skills which lead to a valid and correct solution</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates a partial understanding of concepts and skills associated with task</li> <li>Applies mathematical concepts and skills which lead to an incomplete or incorrect solution</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates no understanding of concepts and skills associated with task</li> <li>Applies limited mathematical concepts and skills in an attempt to find a solution or provides no solution</li> </ul>
<b>Problem Solving</b>	<p>Proficient Plus:</p> <ul style="list-style-type: none"> <li>Problem solving strategy is well developed or efficient</li> </ul>	<ul style="list-style-type: none"> <li>Problem solving strategy displays an understanding of the underlying mathematical concept</li> <li>Produces a solution relevant to the problem and confirms the reasonableness of the solution</li> </ul>	<ul style="list-style-type: none"> <li>Problem solving strategy displays a limited understanding of the underlying mathematical concept</li> <li>Produces a solution relevant to the problem but does not confirm the reasonableness of the solution</li> </ul>	<ul style="list-style-type: none"> <li>A problem solving strategy is not evident</li> <li>Does not produce a solution that is relevant to the problem</li> </ul>
<b>Communication and Reasoning</b>	<p>Proficient Plus:</p> <ul style="list-style-type: none"> <li>Reasoning or justification is comprehensive</li> <li>Consistently uses precise mathematical language to communicate thinking</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrates reasoning and/or justifies solution steps</li> <li>Supports arguments and claims with evidence</li> <li>Uses mathematical language to communicate thinking</li> </ul>	<ul style="list-style-type: none"> <li>Reasoning or justification of solution steps is limited or contains misconceptions</li> <li>Provides limited or inconsistent evidence to support arguments and claims</li> <li>Uses limited mathematical language to partially communicate thinking</li> </ul>	<ul style="list-style-type: none"> <li>Provides no correct reasoning or justification</li> <li>Does not provide evidence to support arguments and claims</li> <li>Uses no mathematical language to communicate thinking</li> </ul>
<b>Representations and Connections</b>	<p>Proficient Plus:</p> <ul style="list-style-type: none"> <li>Uses representations to analyze relationships and extend thinking</li> <li>Uses mathematical connections to extend the solution to other mathematics or to deepen understanding</li> </ul>	<ul style="list-style-type: none"> <li>Uses a representation or multiple representations, with accurate labels, to explore and model the problem</li> <li>Makes a mathematical connection that is relevant to the context of the problem</li> </ul>	<ul style="list-style-type: none"> <li>Uses an incomplete or limited representation to model the problem</li> <li>Makes a partial mathematical connection or the connection is not relevant to the context of the problem</li> </ul>	<ul style="list-style-type: none"> <li>Uses no representation or uses a representation that does not model the problem</li> <li>Makes no mathematical connections</li> </ul>

Name \_\_\_\_\_

Date \_\_\_\_\_

### Possible Graphic Organizers



Starting Point	Ending Point	Distance