Rich Mathematical Task – Grade 5 – *Angle Design*

Task Overview/Description/Purpose:
• In this task, students will create, measure and classify angles within a created geometric design. • The purpose of this task is for students to measure created angles using a protractor and identify as right, acute, and obtuse. • Students should have prior experience using a protractor before completing this task.

Standards Alignment: Strand – *Number and Number Sense*	
Primary SOL: 5.12 The student will classify and measure right, acute, obtuse, and straight angles. **Related SOL:** 4.10ab	
Learning Intention(s): • **Content** - I am learning how to measure and classify angles as right, acute and obtuse. • **Language** - I am learning to use language that describes angle measures and types. • **Social** - I am learning to listen and respond to my peers' explanations in ways that move us all forward as math learners.	
Success Criteria (Evidence of Student Learning): • I can measure the number of degrees in an angle using a protractor. • I can classify angles as right, acute, or obtuse according to their measures. • I can communicate the angle measures and types using geometric language: degrees, right, acute, obtuse. • I can measure and identify angles in my design and justify my reasoning to my peers. • I can give specific feedback and use suggestions to clarify thinking.	
Mathematics Process Goals	
Problem Solving	• Students will create an example geometric design to measure and classify angles using a protractor. • Students will accurately measure angles to classify as right, acute or obtuse.
Communication and Reasoning	• Students will communicate their thinking process for determining angle measures and types within their design. • Students will justify solution process in an organized and coherent matter. • Students will use appropriate mathematical language, including angles, degrees, right, acute, and obtuse to express ideas with accuracy and precision.
Connections and Representations	• Students will use an appropriate representation to explore the problem and justify their solution. • Students will describe connections between their representations and the representations of their peers. • Students will connect and/or extend thinking to other mathematical ideas such as the sum of angles to determine the measure of unknown angles.

Task Pre-Planning
Approximate Length/Time Frame: 60 minutes

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Task Pre-Planning

Grouping of Students: Groups can consist of 2 to 4 students. Teacher should look for opportunities for students to be math leaders and choose student groups that encourage collaboration and perseverance.

Materials and Technology:
- copy of task, pencil
- Virtual Implementation Google Slides
- Virtual Version of Student Task
- grid paper
- protractor
- geoboard

Vocabulary:
- angle
- degrees
- right
- acute
- obtuse

Anticipate Responses: See the Planning for Mathematical Discourse Chart (columns 1-3).

Task Implementation (Before) 10 – 15 minutes

Task Launch:
- Prior to launching this task, allow students to explore using a protractor. As you notice students using a protractor correctly, have them share with class. Clarify questions related to properly using a protractor.
- The teacher will display a photo of a geometric design and ask students where they see geometric designs in their world. Examples below:


- Students may share ideas such as stained-glass windows, building architecture, and art.
- To stimulate relevant geometric vocabulary, ask students what math words they could use to describe these figures and what the words mean. Record any references to angles such as:
  - Right angle measures exactly 90 degrees
  - Acute angle measures greater than zero but less than 90 degrees
  - Obtuse angle measures greater than 90 but less than 180 degrees.
- The teacher will read the task aloud to students alongside the Learning Intentions and Success Criteria. Be sure to review expectations for collaborative work before dismissing into groups. Support materials and manipulatives should be accessible for student use.
- The teacher will ask questions to make sure the task is understood: "What are we trying to figure out?" "What do you already know that can help you get started?" Allow students to turn and talk.

Task Implementation (During) 20 – 30 minutes

Directions for Supporting Implementation of the Task
- Monitor – The teacher will observe students as they work on task and ask assessing or advancing questions as necessary (see *Planning for Mathematical Discourse Chart*).
- Select – Teacher will decide which strategies will be highlighted (after student task implementation) that will advance mathematical ideas and support student learning.
- Sequence – The teacher decide the order in which student ideas will be highlighted (after student task implementation). One suggestion is to look for one common misconception and two correct responses using different strategies to share.

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Task Implementation (During) 20 – 30 minutes

• Connect – The teacher will consider ways to facilitate connections between different student representations.
  ○ As teacher is monitoring, teacher will look strategies that are being used and record on *Planning for Mathematical Discourse Chart*.
  ○ Teacher should use questions to assess or advance student thinking.
  ○ Students should be encouraged to explore different strategies for solving and evaluate effectiveness.

Suggestions for Additional Student Support
May include, among others:
• Sentence frames for supporting student-to-student discourse:
  ○ I agree/disagree with _________'s measurement/classification because _______________.
  ○ I know that 90 degrees is a right angle. Therefore, I know that any measure less than 90 degrees is an _____ angle/greater than 90 degrees is an _____ angle.
  ○ First I am going to _____________. Next I will ______________. I will know I have solved the problem because ______________.
• Using different color rubber bands on geoboard to identify angles.

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:
  ○ a common misconception;
  ○ trajectory of sophistication in student ideas (i.e. concrete to abstract)
  ○ different solutions with reasoning
  ○ different representation of same solution
• Connect student responses and connect the responses to the key mathematical ideas to bring closure to the task. Possible questions to connect student strategies:
  ○ How are these designs alike? How are they different?
  ○ How do these connect to our Learning Intentions?
  ○ Why is this important?
• Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion, such as a gallery walk to allow feedback on all strategies.
• Close the lesson by returning to success criteria. Have students reflect on their progress related to the criteria.

Teacher Reflection About Student Learning:

• Teacher will use the *Planning for Mathematical Discourse Chart* (anticipated student solutions) to monitor which students are using specific strategies. This will include: possible misconceptions, learning trajectories and sophistication of student ideas, and multiple solution pathways. Next steps based on this information could include:
  ○ Informing sequence of tasks. What will come next in instruction to further student thinking in measuring and classifying angles?
  ○ Informing small groups based on misconceptions that are not addressed in sharing.
• After task implementation, the teacher will use the Rich Mathematical Task Rubric criteria to assess where students are in their mathematical understanding and use of the process goals. This could be a focus on one category. Next steps based on this information could include:
  ○ Informing small groups based on where students are in engagement in the process goal(s).

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Planning for Mathematical Discourse

Mathematical Task: ___*Angle Design*___ Content Standard(s): __SOL 5.12_

Teacher Completes Prior to Task Implementation			**Teacher Completes During Task Implementation**	
Anticipated Student Response/Strategy *Provide examples of possible correct student responses along with examples of student errors/misconceptions*	**Assessing Questions** *Teacher questioning that allows student to explain and clarify thinking*	**Advancing Questions** *Teacher questioning that moves thinking forward*	**List of Students Providing Response** *Who? Which students used this strategy?*	**Discussion Order - sequencing student responses** ○ *Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion* ○ *Connect different students' responses and connect the responses to the key mathematical ideas* ○ *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
Anticipated Student Response: Student creates a design that does not meet task criteria.	• Tell me about your design. • Let's go back and reread the task. • Does your design meet the criteria?	• How can you use what you have already done to meet the criteria in the task?		
Anticipated Student Response: Student is unable to start the problem.	• Tell me what you know about this task. • Let's look at the geometric designs from the launch. • Where do you see angles in these designs? What kind of angles?	• See if you can use the geoboard to create a geometric design. Does it meet the criteria in the task?		
Anticipated Student Response: Student is unable to measure angles using protractor.	• Tell me about what you are doing. • Which angle are you trying to measure? • Do you think this angle is right, acute or obtuse? Why?	• So you know this angle is lesser/greater than a right angle. Where would you place the protractor to start measuring? • Does the measurement on the protractor match your prediction?		

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Teacher Completes Prior to Task Implementation			Teacher Completes During Task Implementation	
Anticipated Student Response/Strategy *Provide examples of possible correct student responses along with examples of student errors/misconceptions*	**Assessing Questions** *Teacher questioning that allows student to explain and clarify thinking*	**Advancing Questions** *Teacher questioning that moves thinking forward*	**List of Students Providing Response** *Who? Which students used this strategy?*	**Discussion Order - sequencing student responses** ○ *Based on the actual student responses, sequence and select particular students to present their mathematical work during class discussion* ○ *Connect different students' responses and connect the responses to the key mathematical ideas* ○ *Consider ways to ensure that each student will have an equitable opportunity to share his/her thinking during task discussion*
Anticipated Student Response: Student creates a design that does not show each type of angle.	• Tell me about your design. • What type of angles are in your design? How do you know? • What type of angles do you need to add to your design? What do you already know about these angles?	• How can you add a(n) right/acute/obtuse angle(s) to your design?		
Anticipated Student Response: Student labels shapes within design instead of angles	• Tell me about your design. • Where do you see angles in your design? • Let's go back and read the definition of an angle. • Now that you know what angles are, can you point to one?	• Go ahead and label each angle you see. Then you can begin working on your table.		

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Name______________________________ Date______________________

Geometric Design

A student created a geometric design for the art room wall. The design had the following:

- at least 8 angles
- right angles
- acute angles
- obtuse angles

Create at least one example of the student's design.

- Use a protractor to measure each angle.
- Classify angles as right, acute or obtuse. Record information in the table provided below.

Angle	Angle Type	Angle Measure

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Rich Mathematical Task Rubric

	Advanced	Proficient	Developing	Emerging
Mathematical Understanding	Proficient Plus: • Uses relationships among mathematical concepts or makes mathematical generalizations	• Demonstrates an understanding of concepts and skills associated with task • Applies mathematical concepts and skills which lead to a valid and correct solution	• Demonstrates a partial understanding of concepts and skills associated with task • Applies mathematical concepts and skills which lead to an incomplete or incorrect solution	• Demonstrates no understanding of concepts and skills associated with task • Applies limited mathematical concepts and skills in an attempt to find a solution or provides no solution
Problem Solving	Proficient Plus: • Problem solving strategy is well developed or efficient	• Problem solving strategy displays an understanding of the underlying mathematical concept • Produces a solution relevant to the problem and confirms the reasonableness of the solution	• Problem solving strategy displays a limited under-standing of the underlying mathematical concept • Produces a solution relevant to the problem but does not confirm the reasonableness of the solution	• A problem solving strategy is not evident • Does not produce a solution that is relevant to the problem
Communication and Reasoning	Proficient Plus: • Reasoning or justification is comprehensive • Consistently uses precise mathematical language to communicate thinking	• Demonstrates reasoning and/or justifies solution steps • Supports arguments and claims with evidence • Uses mathematical language to communicate thinking	• Reasoning or justification of solution steps is limited or contains misconceptions • Provides limited or inconsistent evidence to support arguments and claims • Uses limited mathematical language to partially communicate thinking	• Provides no correct reasoning or justification • Does not provide evidence to support arguments and claims • Uses no mathematical language to communicate thinking
Representations and Connections	Proficient Plus: • Uses representations to analyze relationships and extend thinking • Uses mathematical connections to extend the solution to other mathematics or to deepen understanding	• Uses a representation or multiple representations, with accurate labels, to explore and model the problem • Makes a mathematical connection that is relevant to the context of the problem	• Uses an incomplete or limited representation to model the problem • Makes a partial mathematical connection or the connection is not relevant to the context of the problem	• Uses no representation or uses a representation that does not model the problem • Makes no mathematical connections