**Centimeter Robot**

*Adapted from North Carolina Department of Public Instruction*

**Student Objective:** “I can determine the area and perimeter of a rectangle.”

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| **Common Core Standards to Measure** | **Mathematical Practices Addressed** |
| **3.MD.8** Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different | #1 Make sense of problems and preserve in solving them.#5 Use appropriate tools strategically |

**Materials:**

Centimeter grid paper (1 sheet per student)

Construction paper for mounting (2 sheets per student)

Crayons or colored pencils, scissors, glue

Robot example

Computer with projector or computer lab with internet connection

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| G**Engage Students with the Goal** | State and RateObjective: “I can determine the area and perimeter of a rectangle.”Students rate themselves to the goal (1, 2, 3, 4). | Setting Objectives and Providing Feedback |
| A**Access Prior****Knowledge** | Ask students, “Is there a relationship between perimeter and area? How are they the same and how are they different?” Have students write down their responses to these questions in their notebooks and then share their responses.  | Identifying Similarities and DifferencesSummarizing and Note-Taking |
| N**New Information** | This lesson allows students to use their creativity to continue to explore the relationship between area and perimeter. Make an example of a robot before the lesson.**Begin by saying:** We have been exploring area and perimeter of different figures. Today, you will create robots that are made out of rectangles.**Display the example:**  What do you notice about this robot? What is the area of the robot? What is the perimeter? How do you know? Is there a relationship between the two?The first robot will have an area of 63 square centimeters. Please help me find the perimeter of this robot. Record the perimeter near the figure.The second robot will have a perimeter of 46 centimeters. Please help me find the area of this robot. Record the area near the figure.**Introduce the activity:** You will also create two robots. The first robot will have an area of 63 square centimeters. The second robot will have a perimeter of 46 centimeters. Your robot must have at least: one arm, one leg, one head, and follow the lines on the grid. Only draw the outlines for your robots. I will let you know when you may color them and cut them out. | Cues, Questions, and Advance OrganizersNonlinguistic Representations |
| A**Application** | This portion of the lesson provides an opportunity for an informal peer assessment. Students should carefully check each other’s work to ensure it meets the criteria specified earlier. Having students assess at this time also allows them to make changes to their work before it is shared with the class.Provide time for students to create their robots. When they have worked for about 10 minutes, stop the activity.You should have the first robot drawn. Trade papers with a partner. Check your partner’s monster.Does the robot have an area of 63 square centimeters? Does it follow the other rules?Stop the activity again after about 10 additional minutes.You should have the second robot drawn. Trade papers with a partner. Check your partner’s robot. Does the robot have a perimeter of 46 centimeters? Does it follow the other rules?Allow students to work for the remainder of the time. Instruct the students to color and cut out their robots. They may also add details such as a face at this time.Have students write their name and the area and perimeter on the back of each figure. The lesson may be suspended at this point, if necessary.The discussion relates the current lesson to the previous two lessons by having students review what they already know about fixed areas and fixed perimeters. The teacher will need to facilitate having the students order their robots on the board by first determining who has the shortest perimeter/smallest area, then finding the next shortest/smallest, and so on.Have students attach their first robot (A=63) to the board in order from shortest perimeter to longest perimeter.**Facilitate a discussion by asking:**• What do you notice about the robots as the perimeter increases?The robots become longer/taller.• Why? Their square units become more spread out as the perimeter increases.• How does this result relate to what happened with the tables in Spaghetti and Meatballs for All?If the square units are more spread out, there are more sides showing; there are more places for “people to sit.”Have students display their second robot (P=46) in order from smallest area to largest area:• What do you notice about the robot as the area increases? (The robot becomes shorter/smaller.)• Why? (There are not as many sides showing. With fewer turns, there can be more square units for the same perimeter.)• How does this result relate to what happened in Chickens on the Move and “Ben’s Pen”? (We found out that the area gets larger the closer we get to a square, when the perimeter is the same.)A signal should be chosen and practiced before the activity. The signal may be a bell, music, or other sound that will alert the students that it is time to move on to the next partner.As students are discussing, the teacher should monitor the conversations to ensure students are finding the area and perimeter for each figure and to identify any misconceptions to be addressed at the conclusion of the activity. The activity can be limited by time or the number of pairs formed.1. Have students mount their robots onto the construction paper. They should write their name and the area and perimeter for each robot on the back.2. Allow students to mix around the room until the signal is given. At the signal, they should trade papers taking turns finding the area and perimeter for one of their partner’s figures. At the next signal, students will return the papers and mix around the room until the next signal when they find a new partner and repeat the process.3. Address any difficulties the students may have encountered. | Cooperative LearningProviding FeedbackHomework and PracticeIdentifying Similarities and DifferencesCues, Questions, and Advance Organizers |
| G**Revisit the Goal** | Have students write a reflection about their learning in their interactive notebooks.State and RateObjective: “I can demonstrate changes in perimeter for a given area.”Students rate themselves to the goal (1, 2, 3, 4). | Setting Objectives and Providing FeedbackSummarizing and Note-Taking |

**Elaborate on the lesson:**

Time permitting; students could use computers to work on either of these websites:

http://www.shodor.org/interactivate/activities/PerimeterExplorer/

<http://www.shodor.org/interactivate/activities/AreaExplorer/>

**Evaluation:**

**Formative**- As students work, pose questions and observe them.

**Summative** Students’ work from the elaborate section

**Plans for Individual Differences:**

**Intervention**- Students may work in a small group and use smaller numbers.

**Extension -** Challenge students to find the robot with the longest perimeter with an area of 63 square centimeters and the largest area with a perimeter of 46 centimeters.