**Monster Mash**

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| In this lesson, students will be creating monsters using a fixed area and fixed perimeter. |

**NC Mathematics Standards:**

**Measurement and Data**

**NC.4.MD.3** Solve problems with area and perimeter.

* Find areas of rectilinear figures with known side lengths.
* Solve problems involving a fixed area and varying perimeters and a fixed perimeter and varying areas.
* Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Attend to precision.

**Student Outcomes:**

* I can find the perimeter of a figure with a fixed area.
* I can find the area of a figure with a fixed perimeter.

**Math Language:**

* area
* perimeter
* dimensions
* length
* width

**Materials:**

* *Monsters Love Underpants* by Claire Freedman and Ben Cort <https://www.youtube.com/watch?v=Er4IWV8xMg4>.
* centimeter grid paper (2 per student) <https://www.hand2mind.com/pdf/gridpaper.pdf>
* construction paper for mounting (2 per student)
* crayons/colored pencils
* scissors
* glue

**Launch:**

1. Read book and Introduce lesson (5-10 minutes)

Begin the lesson by reading the book *Monsters Love Underpants*. This is a silly book that will get students interested in today’s lesson. After reading the book, explain to the students that today they will be creating monsters using area and perimeter. Students will be creating two monsters. Each monster must have a head, one arm, and one leg. One monster will need to have a fixed area of 63 square centimeters. The second monster will need to have a fixed perimeter of 88 centimeters. You will draw one monster on each sheet of graph paper.

Give students their first sheet of graph paper and have them begin working on their monster that has a fixed area of 63 square centimeters. Students can use whole squares or ½ squares on the grid paper *(teacher discretion for differentiation).*

**Explore:**

1. Explore and Create (20-30 minutes)

Students should begin working on the fixed area monster first. As students finish the fixed area outline, have them switch papers with a classmate to ensure it meets the area requirement. If the area is correct, have students find the perimeter of their monster and record it on the back of their grid paper. Once students have found the perimeter of the first monster, give them their second sheet of grid paper. Students can begin creating a monster with a fixed perimeter of 88 centimeters. Once the outline is complete, have students switch papers with a classmate to ensure it meets the perimeter requirement. Once correct, have students find and record the area of their second monster on the back.

As students work ask them questions such as:

* What strategy are you using to create your monster?
* How does knowing the perimeter help you?
* How do you know you are correct?
* What strategies are you using to solve this task?

Once students have completed both monsters and found the area and perimeter of each, instruct them to color and cut out their monsters. They may also add details such as a face. Once the monsters have been cut out, have students glue them on the construction paper. *(One monster per sheet of construction paper.)* After gluing, students need to give their monster a name (at the top of the paper) and record the area and perimeter of the monster at the bottom.

**Discuss:**

1. Discussion of Fixed Area/Fixed Perimeter (30 minutes)

Ask students to post their first monsters (the monsters with an area of 63 square centimeters) to the board or laid out in some manner so everyone can see them all. Ask students to look at the perimeter of the monsters carefully. Ask students to share the observations they have about the monsters. (Students should notice all have the same area, but not all have the same perimeter. They may suggest to re-order them from smallest to largest perimeter. Have students reorder them if so.)

Facilitate a discussion by asking:

* *Why don’t all of the monsters have the same perimeter?*

Fixed areas don’t always yield the same perimeter.

* *What do you notice about the monsters as the perimeter increases?*

The monsters become longer/taller.

* *Why do the monsters become taller?*

Their square units become more spread out as the perimeter increases.

Have students display their second monsters (perimeter of 88 centimeters) on board or laid out in some manner for all to see. They may decide to place them in order from smallest area to largest area.

* *What do you notice about the monsters as the area increases?*

The monsters become shorter/smaller.

* *Why?*

There are not as many sides showing. With fewer turns, there can be more square units for the same perimeter.

**Evaluation of Student Understanding**

**Informal Evaluation:**

* Observe the strategies students use to create their monsters with fixed areas and perimeters.

**Formal Evaluation/Exit Ticket:**

* Give students a fixed area of 12 square units and ask them to create at least 3 different rectilinear shapes with that area. Give students a fixed perimeter of 18 square units and ask students to create at least 3 different rectilinear shapes with that perimeter.

**Meeting the Needs of the Range of Learners:**

**Interventions:**

* Students may work in a small group and use smaller numbers as the area or perimeter.
* Students may also need square tiles to build before drawing their monster.

**Extensions:**

* Challenge students to find the monster with the largest perimeter with an area of 63 square centimeters and the largest area with a perimeter of 88 centimeters.

**Possible Misconceptions/Suggestions:**

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| **Possible Misconceptions** | **Suggestions** |
| * Students may have trouble working with large numbers for the fixed area and perimeter. * Trouble distinguishing between area and perimeter. | * Use a fixed area of 16 square centimeters and a fixed perimeter of 20 centimeters. * Use square tiles to help students visually see and build the monster. |

**Possible Solutions:**

* Answers will vary depending on the monster created.