

Mathematics: The Language of STEM
Area and Perimeter

CONTENT AND TASK DECISIONS

Grade Level(s): Fourth Grade

Description of the Task:

Students will draw a shape given a particular area and compare its perimeter to a different shape with the same area.

Indiana Mathematics Content Standards:

4.M.4: Apply the area and perimeter formulas for rectangles to solve real-world problems and other mathematical problems. Recognize area as additive and find the area of complex shapes composed of rectangles by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts; apply this technique to solve real-world problems and other mathematical problems.

Indiana Mathematics Process Standards:

PS.3: Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They analyze situations by breaking them into cases and recognize and use counterexamples. They organize their mathematical thinking, justify their conclusions and communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. They justify whether a given statement is true always, sometimes, or never. Mathematically proficient students participate and collaborate in a mathematics community. They listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Mathematics Content Goals:

Students will understand that the measurement of area is separate from the measurement of perimeter.

Language Objectives:

Students will be able to explain their reasoning and prove their answers in writing using clear, mathematical vocabulary.

Materials:

graph paper, pencils, straight edge, lined paper, tiles (You may choose to use these in place of drawing or along with the drawing.)

THE LESSON

Before:

- Student Actions
 - Students will be given the situation. They will discuss at their tables if this conclusion is correct and explain why or why not. They will participate in the class discussion.
- Teacher Actions
 - Teacher explains the situation (you can change the scenario to make it more personal to you): *I was helping my niece last night with one of her homework assignments on area and perimeter. I am wondering if she was correct in her thinking...She said that shapes that have the same area, also have the same perimeter. Do you agree? Why or why not?* (Discuss) *“Let’s do some activities that will help us justify our thinking.”*

During:

- Student Actions
 - Students will complete the task of drawing two shapes that have an area of 12 and then two shapes that have a perimeter of 12. Each shape’s measurements will be labeled. Students will explain in writing if the person in the story was correct in her thinking. Students will be expected to use correct mathematical vocabulary in their explanations.
 - If students need more hands-on experiences, instead of drawing, students may create the shapes with tiles. They may use the tiles in their explanation or to help them create their drawings.
- Teacher Actions
 - Teacher will provide the graph paper, rulers, and tiles. He or she will monitor student understanding as they work by observing and asking questions.
 - Some possible questions:
 - How did you reach that conclusion?
 - What information do you have?
 - How would you prove that?
 - Does that make sense?

After:

- Student Actions
 - A few students will be selected to share their thinking with the other students under the document camera. The teacher will choose students that may have displayed a common misunderstanding. Another student may be chosen because he or she showed a correct understanding of the concept. He or she should also select students that are willing to show what they did.
- Teacher Actions
 - Teacher will facilitate the discussion by asking questions that promote student thinking and understanding.

ASSESSMENT

Observe:

- Are students using appropriate math vocabulary?
- As students are drawing separate shapes, are they noticing the perimeter is not necessarily determined by the area alone and vice versa?

- Are the students able to support their thinking with evidence from their drawings?

Ask:

- If a shape has an area of 12 square units, will it automatically have a perimeter equal to all other shapes that have an area of 12 square units? Explain why or why not.
- If two shapes have equal perimeters, will they also have the same area? Explain why or why not.
- Papers will be collected so the teacher can read each student's explanation.