

Sample Lesson

Title of Lesson: Pizza Problem

Brief Overview: In this lesson, students will use the properties of circles as well as the formulas for area and circumference of circles to solve real world applications. These foundational math skills can be used to answer and explain situations they will encounter throughout their lives. Students will be presented with two conditions where they must look at the prices of pizzas and how diameter sizes affect the area and pizzas. They will use the formulas for area and the given information to make an informed decision about which pizza is a better deal. They will then create their own misleading pizza flyer in order to better understand how producers can mislead consumers.

Essential Questions Addressed:

Overachieving

1. Does a mathematical model represent a tool for making real decisions?

Topical

1. What are the formulas to find the area and perimeter (circumference) of polygons and circles as well as for volume and surface area of common solids?
2. Which portions of the formula are given within the problem and which do you need to find in order to work towards the solution of the problem?

Background: A circle is a shape with all points the same distance from the center point of the circle. If a line segment is drawn through the center point of the circle, touching each side, a diameter of the circle is created, and will be the same length at any portion of the circle that is split in half. Half of the diameter, or a line segment drawn from the center point of the circle to one side of the circle is called the radius. The radius is always half of the length of the diameter, and vice versa, the diameter is always double the length of the radius. If the distance around the circle (the circumference) is measured and divided by the distance through the circle center (the diameter), the value of the answer should be (or really close to, dependent of the accuracy of the measurements) that of the symbol pi (π). Pi is a Greek symbol that represents the number 3.141592653... and goes on to an infinite amount of decimal places. The area of the circle is represented by the equation $A = \pi r^2$ and the circumference of any circle can be found using the equation $C = \pi d$ where r is the radius of the circle and d is the diameter.

Content: The content of this lesson is based on students being given a prompt where they have ten dollars and have to decide which pizza deal is a better value (i.e. which deal they will get more pizza for their money). Students often eat pizza and see many “deals” in the media and their everyday life. They often have to make decisions about which situation is better for what they are looking for.

Misconceptions: Students often think that π is that same as 3.14. Students also interchange the formulas for area and circumference. Misunderstanding the value of pi as 3.14 instead of 3.14 being an approximation to a value that goes on with an infinite amount of decimal places. In the formulas, students may also replace the portion used to represent radius with the formula for diameter ($2r$).

Standards:

- G.GMD.1— Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*
- G.MG.1— Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).
- G.MG.3— Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios)

Objectives:

- Given two real world situation, students will use the given information and area formulas to decide which situation is a better deal
- With a partner, students will create a misleading flyer along with explanation and mathematical reasoning, where the consumer will think they are getting more pizza from three smaller pizzas than from one larger pizza

Framing Learning: (approximately 45 minutes)

1. Tell each student they have \$10 and that they have a choice of buying two 9" pizzas for \$10 or one 14" pizza for the same price. Without using any mathematics, allow students to choose which deal they think is better.
2. Poll students to see which deal was chosen.
3. Ask students "What do we need to know in order to find out which deal is better?" Allow students to respond and discuss.
4. Quickly review the parts of the circle, the formulas for area and circumference, and the difference between diameter and radius.
5. Discuss real world situations where one would need to know the circumference and areas of circles.
6. Discuss the question from the beginning of the lesson, "Is it better to buy two 9" pizzas for \$10 or one 14" pizza for the same price. Allow students to work in pairs to discover the answer.
7. Have the class to come back together and discuss the answer. Also discuss why this could be misleading to a consumer.
8. Go over advertisement description and rubric.
9. Students go back with their partner and work on the following open-ended problem: "Make an advertisement sign for a pizza company. Advertise a deal of 3 pizzas for a certain price verses one pizza for the same price. The one pizza MUST be the better deal. HINT: You are trying to fool the customer just like I fooled you. Show any mathematical procedures that prove that the one pizza is a better deal than the three pizzas. Write in words the procedures that you used to come up with the sizes of the pizzas. Also, explain in words why your advertisement may seem misleading to the customers."
10. Have student present their advertisement and other accompanying work. Students explain their answers to the open-ended problem and the mathematical procedures they used to find the answer.
11. How a discussion with the class about what they learned and how they could use this knowledge in the read world.

Assessment: Student will create the advertisement that is geared to mislead the consumer on spending the same amount of money on less pizza. They will also show and explain their work as well as provide and explanation of why the advertisement can be misleading.

Rubric:

Assessment Criteria	1	2	3
Depth of Understanding	Little understanding of area; many mathematical errors	Some understanding of the area; few mathematical errors	In-depth understanding of area; well-developed explanations
Fluency	Incomplete approach or unworkable approach	A workable approach with little detail added	A workable approach with lots of detail added
Originality	Method leads to a solution, but is fairly common	Unusual method; this method is workable and only used by a few students	Unique method; this method is used only by one or two students
Elaboration or Elegance	Little explanation is given about procedures used to find area	Some explanation is given about process used to find area	In-depth, clear, precise explanations are given about procedures used to find areas; makes good use of models and equations
Generalizations and Reasoning	Very few generalizations are made about why area is misleading to customers or incorrect reasoning	Some generalizations are made about why area is misleading to customers; supported with clear reasoning	Several well-supported generalizations about why area is misleading to customers; clear supported reasoning

Special Considerations to Include all Learners: Students with specific weaknesses can be paired with students to balance these weaknesses. Some students have difficulties with their hand writing or drawing neatly. The computer lab can be made available for students to do work on. Students can be provided with graphic organizers or the assessment can be broken down into more manageable parts (see below). Cooperative learning strategies will also be used to include all learning ability levels and move all students to a higher ZPD. Students will be placed in heterogeneous groups. If groups or pairs are working at a higher level and finish early, there will be sponge activities with informational readings and mini activities where students must extend their thinking to complete.

Steps	Notes
Examples	