

Stained Glass Surprise

Amy's math class wanted to make her a special geometric surprise! They decided to make a mobile out of stained glass in the shapes and sizes of tangram pieces. The glass for this project costs 50 cents for every $3\frac{1}{2}$ centimeters square, (This is the same size of the square tangram piece.) Metal edging is used to surround and protect each piece of glass. This metal costs 5 cents for every 1 centimeter.

Using the information from above, figure the total cost of making the gift. Which will be most expensive to purchase, the glass or the metal for the gift? How do you know?

Remember to show how you solved the problem and make clear to the reader why you did what you did.

Exemplars

Stained Glass Surprise

Suggested Grade Span

3-5

Task

Amy's math class wanted to make her a special geometric surprise! They decided to make a mobile out of stained glass in the shapes and sizes of tangram pieces. The glass for this project costs 50 cents for every $3\frac{1}{2}$ centimeters square, (This is the same size of the square tangram piece.) Metal edging is used to surround and protect each piece of glass. This metal costs 5 cents for every 1 centimeter.

Using the information from above, figure the total cost of making the gift. Which will be most expensive to purchase, the glass or the metal for the gift? How do you know?

Remember to show how you solved the problem and make clear to the reader why you did what you did.

Alternate Versions of Task

More Accessible Version:

Amy's math class wanted to make her a special geometric surprise! They decided to make a mobile out of stained glass in the shapes and sizes of Tangram pieces. The glass for this project was donated. Metal edging is used to surround and protect each piece of glass. How much metal will be needed to complete the project? How do you know?

Remember to show how you solved the problem and make clear to the reader why you did what you did.

More Challenging Version:

Amy's math class wanted to make her a special geometric surprise! They decided to make a mobile out of stained glass in the shapes and sizes of Tangram pieces. Liquid glass for this project costs 50 cents for every 10 cubic centimeters. Metal edging is used to surround and protect each piece of glass. This metal costs 5 cents for every centimeter.

Using the information from above, figure the total cost of making the gift. Which will be most expensive to purchase, the glass or the metal for the gift? How do you know?

Remember to show how you solved the problem and make clear to the reader why you did what you did.

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Context

We have been doing a geometry unit in math. We have been doing a lot of work with tangrams. Many of the students had begun to make observations about certain pieces being "the same size" such as the square and the medium triangle. We had been talking a lot about congruent and similar shapes, but the children were confused with this situation: They knew that both pieces were worth two small triangles, but that they were not congruent or similar. This was the perfect lead-in to a class discussion on area and perimeter. This task, although used as an assessment piece, was actually the children's first experience requiring them to compare area and perimeter of shapes. The findings were quite surprising to some.

What This Task Accomplishes

This task requires students to use many different types of mathematics: Finding area and perimeter of shapes, figuring costs per unit, measuring shapes and computing numbers. Since this task incorporates the strands of geometry and measurement, students are provided with a rich opportunity to communicate their solutions using a wide variety of mathematical language.

What the Student Will Do

Students initially spent 10 or 15 minutes conferencing with each other to discuss strategies for solving this problem. Once the students got to work, they all seemed to take a different approach to solving the task. Some children started with area, some with perimeter. Some children initially did a lot of work mentally and then went back and documented it after they finished the task. Some children made tables to keep track of their data, while others used diagrams.

The children went about the task of figuring out the prices of the edging and the glass in many ways, (especially the edging). Some found the perimeters of each shape, added them all together and then multiplied that sum by 5 cents. Others did the pricing by side or shape, while others measured a side and then counted by fives on their rulers for every centimeter! The children that did this initially ran into some problems with the sides that were half centimeters. This dilemma was soon remedied when students realized that two halves equaled a whole and that there were no perimeters that involved fractions.

Time Required for Task

1 - 2 hours

Interdisciplinary Links

This is a great task to do with a geometry unit. This task would also compliment a social studies or science unit that involved buildings with stained glass windows.

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The concept of area and perimeter is similar in a quilt border and could be re-written as such. You could also do this task during holidays to make gifts for families, creating either mobiles, stained glass and wallpaper pattern designs using tangrams or pattern blocks as tracers.

Teaching Tips

The time we had spent exploring area before we did this task was mostly with tangrams. We had a large discussion on the difference between $3 \frac{1}{2}$ square centimeters and $3 \frac{1}{2}$ centimeters square. I would highly recommend having this discussion before doing the task. Our class discussion led right into a discussion about square numbers!

When children were measuring their tangrams we discussed that we were measuring to the nearest $\frac{1}{2}$ centimeter. This was not a problem for my students, but be aware that if the students trace the tangrams and then measure the tracing, instead of the actual manipulative, their measurements may be different. All of my students measured the actual tangram. The problem with this was that it made making diagrams an afterthought instead of part of the initial response.

Suggested Materials

- Tangrams
- Centimeter rulers
- Centimeter graph paper
- Lined paper
- Calculators

Possible Solutions

Assuming that the students measure the actual tangrams, the cost of the glass is \$4 and the cost of the metal edging is \$6. The total cost of the gift is \$10.

Remember, if the children measure their diagrams instead of the tangrams, answers will vary. See Practitioner and Expert benchmarks for measurements of individual pieces.

More Accessible Version Solution:

See the solution for the original version.

More Challenging Version Solution:

Students will need to compute volume instead of area. Solutions will vary depending on the dimensions of the Tangrams you use.

When assessing the student's solution, evaluate correctness of computations and mathematical reasoning.

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Task Specific Assessment Notes

Novice

Although the student seems to have some idea of how area is measured, there is no evidence that s/he understood the task, there is no evidence of a strategy used to solve the problem and there is no solution. It is not clear that the child understood the task.

Apprentice

This student does a great job of finding the perimeter of each shape, but does not go any further. This student does not complete the task.

Practitioner

The student has a good understanding of area and perimeter and applies it accurately and appropriately. The student clearly describes the procedures followed and uses appropriate representation.

Expert

The student accurately identifies the math concepts necessary to solve this problem. S/he applies procedures accurately and solves the task in an organized way. The student incorporates mathematical observations into the solution. The student's explanation is effective and clear. Math language and representation is appropriate and meaningful.