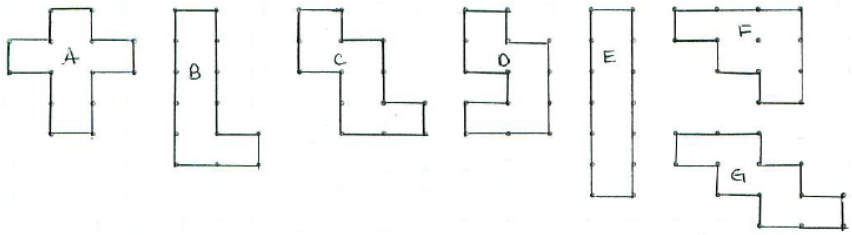
Teaching Through Problem Solving
Math 8

Curriculum Links	Problem
8SS4	You have been asked to design an aquarium in the shape of a rectangular prism for the school visitor's lounge. Because of the type of fish being purchased, the pet store recommends that the aquarium should hold 24 cubic feet of water. Find as many different dimensions for the aquarium as possible. Then decide which aquarium you would recommend for the lounge and explain why you made that choice.
8SS4 8SS1 8PR1 8N1 8N5	Math in the Box - Students create an origami box and then investigate the relationship between the size of the paper used and the volume of the box created. During activity students will take measurements, calculate volume, apply Pythagorean theorem, extend and represent patterns. See Appendix 1
8N5	 Farmer Brown had three pens, each with the same number of animals. Pen A held cows, pen B held sheep, and pen C held pigs. One day, his careless nephew released all the animals from their pens. The farmer rushed to get the animals in any pen. Each pen now held a mixed group of cows, sheep, and pigs. He noticed the following when counting the animals: • Each pen held the same number of animals as it did before the animals were released. • The number of pigs in pen A was the same as the number of pigs in pen B. • The number of sheep in pen A was the same as the number of sheep in pen C. • The number of sheep in pen A was 2/3 the number of pigs in pen A. How does the number of cows in pen B compare with the number of cows in pen C?
8SP2 8SS1	You are going to roll three regular six-sided dice and use the numbers that are rolled as sidelengths of a triangle. As a class, predict which of the following is most likely? Least likely? Support your prediction. a) Rolling sidelengths that will form an equilateral triangle. b) Rolling sidelengths that will form an isosceles triangle. c) Rolling sidelengths that will form a scalene triangle. d) Rolling sidelengths that will form a right triangle.

	e) Rolling sidelengths that will not form a triangle. Test your theory experimentally as a class. Were the results what you expected? Explain.
8SS2	Joe draws the following nets for his die, each with 6 square faces.  When he cuts them out and folds them up, will each of them form a cube? Are there other nets that could be drawn that will form a cube? How many?

Appendix 1 – Math in the Box

Getting Started

- Start with a piece of paper that is 5.5 inches by 5.5 inches. Follow the oregami instructions to fold the paper into a box. Determine the volume of the box.

Problem

- Can you predict the volume of the origami box that would be formed if you had started with a piece of paper that was 10 inches along each side? Check to see if your prediction is accurate.
- Can you explain how to determine the volume of the box that would be formed for any size of paper?
- Describe the relationship between the original length of the paper (or length of the diagonal of the paper) and each of the following using an algebraic expression, table of values, and graph.
    - Length of the box.
    - Height of the box.
    - Area of the base of the box.
    - Volume of the box.

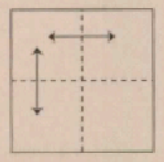
Talking Points

- Are the relationships between the original paper length (or the length of the diagonal) and box length, box height, area of base, and volume linear? How do you know? Is the data discrete or continuous? Are these sets of data proportional?
- Is the relationship between the length of the side and the length of the diagonal proportional? How do you know? How could you represent this relationship algebraically?
- How are the dimensions of the origami box related to each other? Could you calculate the volume box if all you knew was the height of the box? The area of the base? The length of the base? The width of the base?
- How did your ability to take accurate measurements affect your results? Were your measurements accurate? How do you know?

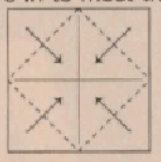
Fig. 1 The folding instructions prepare a flat piece of paper to become a net that is then studied for resulting patterns.

Five-Sided Box Folding Instructions

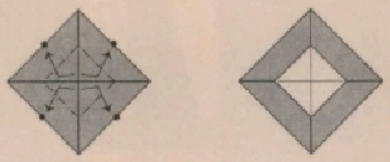
1. Fold the square in half vertically and unfold, and then fold it horizontally and unfold.



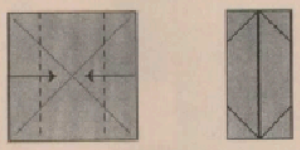
2. Fold each corner of the square in to meet the center.



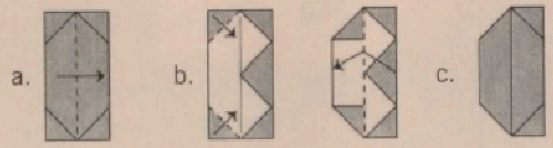
3. Fold each of the original corners under so that they touch the midpoints of their respective sides.



4. Turn the paper over to the back side. Fold the left and right edges in so that they meet in the center of the paper.

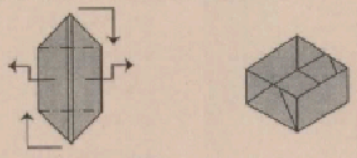


5. a. Fold just the left flap over to meet the right edge.
   b. Fold the small triangles on the top and bottom of the left side in to the midline.
   c. Fold the flap back over along the midline to meet the left edge.



6. Repeat step 5 using the right flap so that the paper looks like the shape below.

7. Crease where indicated by the dashed lines and pull the sides out while pushing the top and bottom in to finish the box.



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