Volume and Surface Area

This activity explores the relationship between
a) the volume of a pyramid and its related prism
b) the volume of a cone and its related cylinder
c) surface area and volume of a rectangular prism

I. Volumes of Prisms and Pyramids
1. Examine the given prism and pyramid.
2. What is true about the areas of the bases of the prism and the pyramid?
3. What is true about the heights of the prism and the pyramid?
4. Fill the pyramid with rice. Pour the rice into the prism. Repeat the process until the prism is full.
5. One prism full of rice = _____ pyramids full of rice.
6. Write a ratio that compares the volume of the pyramid to the volume of the prism.
7. On the basis of this exploration and the ratio you found, write a rule to determine the volume of a pyramid based on the formula for the volume of a prism.

II. Volumes of Cylinders and Cones
1. Examine the given cylinder and cone.
2. What is true about the areas of the bases of the cylinder and cone?
3. What is true about the heights of the cylinder and cone?
4. Fill the cone with rice. Pour the rice into the cylinder. Repeat the process until the cylinder is full.
5. One cylinder full of rice = _____ cones full of rice.
6. Write a ratio that compares the volume of the cone to the volume of the cylinder.
7. On the basis of this exploration and the ratio you found, write a rule to determine the volume of a cone based on the formula for the volume of a cylinder.
III. Surface Area and Volume of Rectangular Prism

1. Cut out a 17 unit x 24 unit rectangle from graph paper. Cut one square from each corner of the paper. Fold up the sides to make an open-top box. Be careful not to overlap the paper. Use the squares on the paper to determine the area of the base, the height of the box, the surface area of the box, and the volume of the box. Form new boxes by successively cutting 2 x 2, 3 x 3, etc. squares from each corner of a 17 unit x 24 unit rectangle. Find the new measurements and enter the data for each box in the table. Tape or staple the final net to your paper and turn it in.

<table>
<thead>
<tr>
<th>Dimensions of Squares Cut Out</th>
<th>Area of base</th>
<th>Height</th>
<th>Surface Area</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x 1</td>
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<td>2 x 2</td>
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<td>8 x 8</td>
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2. What are the dimensions of the box with the greatest volume?

3. Does that box also have the greatest surface area?

4. As surface increases, does the volume also increase? Explain.

5. If you were a manufacturer of food boxes, how would you use the results of this activity to minimize costs and maximize profits? (Your answer should be a general principle based on what you see in the chart, not specific numbers.)