Finding Volume and Surface Area of Three Dimensional Space Figures

Mr. Lewis Prisco
lewis.prisco@browardschools.com

Grade Level: 8^{th}
Time Frame: 10 hours

Learning Outcomes: Students will be able to find Surface Areas and Volumes for Prisms, Cylinders, Pyramids, Cones, and Spheres.

Prerequisite Knowledge: Students should know how to classify polygons, and be able to find area and perimeter of triangles, quadrilaterals, and circles.

Student Materials: cone.html, cylinder.html, rectangular_prism.html, rectangular_pyramid.html, sphere.html, triangular_prism.html, triangular_prism1.html, triangular_pyramid.html

Teacher Materials: cone.ggb, cylinder.ggb, rectangular_prism.ggb, rectangular_pyramid.ggb, sphere.ggb, triangular_prism.ggb, triangular_prism1.ggb, triangular_pyramid.ggb

Technology: Java, GeoGebra, LCD projector & student computers

Vocabulary: polyhedron, edge, vertex, tetrahedron, regular polyhedron, bases, lateral faces, lateral edges, prism, oblique prism, altitude, height, pyramid, height, cross-section sphere, center, great circle, cylinder, radius, right cylinder, oblique cylinder, altitude, cone

Sunshine State Standards: MA.B.1.4.1 MA.B.3.4.1

Procedure:
Activity: 1
Step 1: Discuss the formula used to find the volume of a prism. Talk about what the "B" means in relation to the formula: area of the base, which is a rectangle. Discuss the dimensions needed in order to calculate volume: length and width of base and height of prism.

Step 2: Discuss the fact that there is no formula for the surface area of a prism. Show students a flat pattern of a prism and discuss how we might be able to come up with one by analyzing the net. Have them come to the conclusion that there are 3 sets of 2 rectangles that make up the 6 sides. We can conclude that by taking the area of each of the 3 sets of rectangles and multiplying it by 2, and then taking the sum of them all, we can calculate the total surface area.

Step 3: Have the students look at the GeoGebra File for a Rectangular Prism (This same Activity can be used for the Triangular Prism, Rectangular Pyramid, and Triangular Pyramid ggb files as well). Have the students calculate the volume and surface area by giving them some random dimensions of the 3-D shapes in the ggb files. The teacher can easily make adjustments to the dimension sliders to create hundreds of examples. The teacher can show or hide the formulas and solutions on the worksheets.

Step 4: Have students experiment with how the volume and surface area change as you proportionately change the dimensions, using both an enlargement and a reduction. Is there a relationship to scale factor? If so, what is it? Students can use the Rectangular Prism html to do this on their own. (Works for Triangular Prism, Rectangular Pyramid, and Triangular Pyramid html files as well)

Activity: 2
Step 1: Discuss the formula used to find the volume of a cylinder. Talk about what the "B" means in relation to the formula: area of the base, which is a circle. Discuss the dimensions needed to calculate volume: diameter or radius (what the relationship is between diameter and radius) and the height of the cylinder.

Step 2: Discuss the formulas used to calculate the surface area of a cylinder. What is the difference between the lateral and total formulas? Show students a flat pattern of a cylinder so that they can see the lateral is a rectangle that forms the circumference of the top and the base, and the width of the rectangle is the height of the cylinder. The total formula includes the lateral and both the top and base.
Step 3: Have the students look at the GeoGebra File for a Cylinder (This same Activity can be used for the Cone and Sphere ggb files as well). Have the students calculate the volume and surface area by giving them some random dimensions of the 3-D shapes in the ggb files. The teacher can easily make adjustments to the dimension sliders to create hundreds of examples. The teacher can show or hide the formulas and solutions on the worksheets.

Step 4: Have students experiment with how the volume and surface area change as you proportionately change the dimensions, using both an enlargement and a reduction. Is there a relationship to scale factor? If so, what is it? Students can use the Cylinder html to do this on their own. (Works for Cone and Sphere html files as well)

Checking for assessment: Each html worksheet has questions for the students to answer at the bottom of the page. These can be collected for a grade or the teacher can use a standard textbook test from the book that goes with this section.