

Surface Area with Polydrons

Overview

Students will be able to calculate surface area of 3-dimensional constructions created from Polydrons.

Benchmarks

3-4 Grade

Measurement

- A. Select appropriate units for perimeter, area, weight, volume (capacity), time and temperature, using:
- objects of uniform size
 - U.S. customary units; e.g., mile, square inch, cubic inch, second, degree Fahrenheit, and other units as appropriate
 - metric units; e.g., millimeter, kilometer, square centimeter, kilogram, cubic centimeter, degree Celsius, and other units as appropriate
- D. Identify appropriate tools and apply counting techniques for measuring side lengths, perimeter and area of squares, rectangles, and simple irregular two-dimensional shapes, volume of rectangular prisms, and time and temperature.

Geometry and Spatial Sense

- A. Provide rationale for groupings and comparisons of two-dimensional figures and three-dimensional objects.

5-7th Grade

Measurement

- A. Select appropriate units to measure angles, circumference, surface area, mass and volume, using:
- U.S. customary units; e.g., degrees, square feet, pounds, and other units as appropriate

- metric units; e.g., square meters, kilograms and other units as appropriate
- C. Identify appropriate tools and apply appropriate techniques for measuring angles, perimeter or circumference and area of triangles, quadrilaterals, circles and composite shapes, and surface area and volume of prisms and cylinders.
- D. Select a tool and measure accurately to a specified level of precision.
- E. Use problem solving techniques and technology as needed to solve problems involving length, weight, perimeter, area, volume, time and temperature
- G. Understand and demonstrate the independence of perimeter and area for two-dimensional shapes and of surface area and volume for three-dimensional shapes.

Geometry and Spatial Sense

- D. Identify, describe and classify types of line pairs, angles, two-dimensional figures and three-dimensional objects using their properties.

8-10th Grade

Measurement

- B. Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision.
- C. Apply indirect measurement techniques, tools and formulas, as appropriate, to find perimeter, circumference and area of circles, triangles, quadrilaterals and composite shapes, and to find volume

of prisms, cylinders, and pyramids.

Geometry and Spatial Sense

E. Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology.

Vocabulary

Area

Surface Area

Centimeters

Inches

Polygon

Quadrilateral

Triangle

Pentagon

Length

Width

Base

Height

3-dimensional Objects

Time

45 minutes to 1 hour

Materials

Polydrons

Graphic Organizer

Calculator

English and Metric Ruler

Procedure

1. Distribute Polydron sets to students.
2. Instruct students to construct a 3-dimensional object using the Polydron shapes. The Difficulty level can be increased by requiring

- the students to use a defined number of Polydron shapes and/or using specific Polydron shapes.
3. Once students have 3-dimensional objects constructed, the students should then identify the three primary polygons used in their 3-dimensional objects, i.e. quadrilateral, triangle, and pentagon.
 4. Continue by having the students identify properties of each of the three primary polygons used in the model constructions.
 5. Conclude the discussion by having the student state the formulas for finding the area of each of the three primary polygons used in the model constructions.
 6. Distribute the graphic organizers, rulers, and calculators to the students and instruct the students to find the surface area of their 3-dimensional constructions by using the graphic organizer. Students should measure their 3-dimensional objects in either inches or centimeters, or both.

Informal Assessment

Student participation of building the 3-dimensional Polydron constructions, student oral responses to guided questioning, and student progress of graphic organizers can be assessed during the lesson as the teacher monitors each student's work and participation.

Formal Assessment

The completed graphic organizer will serve as the formal assessment to evaluate each student's understanding and ability to demonstrate correct calculation of surface area of 3-dimensional objects.

Interventions for Students with Disabilities

1. Allow students to work in Pairs.
2. Provide students who cannot perform calculations with fractions or decimals with a value for length, width, base, and height that makes for even triangle area calculations. In addition, this would be beneficial to students with visual impairments who cannot see to conduct fine measurements.
3. Provide the formulas for the students in the graphic organizer.
4. Complete the graphic organizer with the student explaining each step of the process until the student can do the process independently.

5. Build the Polydron object for the students who may not be able to build the model themselves.
6. Limit the number of Polydron shapes or specific polygons used in making the model to reduce the complexity of building the models and calculations for surface area.

Extension Activities

1. Instruct the students to design and build a class construction using all of the Polydron sets and culminate the activity by finding the surface area of the giant Polydron object.
2. Complete all of the surface area calculations in a specified unit of measure and instruct the students to complete a unit of measurement conversion from English to Metric, or various units of measurement from small to large within the English or Metric systems of measurement.
3. Instruct the students to switch from finding surface area to finding the volume of their 3-dimensional objects made from Polydrons.

