



Math Practice 1: Area and Volume— Teacher Instructions

Teacher Introduction

In the FSI: Tranquility Base mission, students will have to calculate the area of several sides and the total volume of the storage facility in order to analyze the progression of the fire. Visualizing irregular three-dimensional objects and the concepts involved in determining surface areas and volumes is sometimes difficult for students.

This activity should help them to visualize the storage facility. By constructing a three-dimensional object, students will be able to better understand the dimensions of their “room” and will master the calculations more quickly.

Vocabulary

Area- the number of square units needed to cover a closed figure.

- **Area of a rectangle = length x width**
- Area is measured in square units.

Combined area- the sum found from adding the areas of specific sides of a shape.

Total surface area - the sum of the area of each side or surface of an object.

- To find the surface area of an object, calculate the area of each side and add.

Volume- the amount of space an object occupies.

- **Volume of a rectangular object= length x width x height**
- Volume is measured in cubic units.

Math Standards

Grades 6-8: Measurement Standard

Understand measurable attributes of objects and the units, systems, and processes of measurement.

- Understand, select, and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume.

Apply appropriate techniques, tools, and formulas to determine measurements.

- Select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision.
- Develop strategies to determine the surface area and volume of selected prisms, pyramids, and cylinders.

Materials

- Copies of Math Practice 1
- Ruler or measuring tape
- Scissors
- Tape
- Calculators (optional)
- Pencil

Procedure

1. Distribute the Math Practice 1 activity to your students. Read the Introduction and Vocabulary sections together.
2. Direct your students to work through the Procedure section of Math Practice 1. Students should answer the questions in the Procedure section based on the measurements they have made.
3. Review the answers to the questions as a class using the answer key as your guide.

Answer Key

1. Students construct the box using the pattern on page two of Math Practice 1. Monitor student progress to ensure the box is constructed properly.
2. Position section A1 on top and use a ruler or measuring tape to measure the length and width of each side of the box (in centimeters).

$$A1 = 4 \text{ cm} \times 4 \text{ cm}$$

$$A4 = 4 \text{ cm} \times 3 \text{ cm}$$

$$A2 = 4 \text{ cm} \times 4 \text{ cm}$$

$$A5 = 4 \text{ cm} \times 3 \text{ cm}$$

$$A3 = 4 \text{ cm} \times 3 \text{ cm}$$

$$A6 = 4 \text{ cm} \times 3 \text{ cm}$$

3. Find the area of section A1.

$$\text{Area} = \text{length} \times \text{width}$$

$$= 4 \text{ cm} \times 4 \text{ cm}$$

$$= \mathbf{16 \text{ cm}^2}$$

4. Find the combined area of sides A1, A3, and A4.

$$\text{Combined area} = A1 + A3 + A4$$

$$A1 = 4 \text{ cm} \times 4 \text{ cm} = 16 \text{ cm}^2$$

$$A3 = 4 \text{ cm} \times 3 \text{ cm} = 12 \text{ cm}^2$$

$$A4 = 4 \text{ cm} \times 3 \text{ cm} = 12 \text{ cm}^2$$

$$\text{Combined area} = 16\text{cm}^2 + 12\text{cm}^2 + 12\text{cm}^2$$

$$\text{Combined area} = \mathbf{40 \text{ cm}^2}$$

5. Find the total surface area of the box.

$$\text{Total surface area} = A1 + A2 + A3 + A4 + A5 + A6$$

$$A1 = 4 \text{ cm} \times 4 \text{ cm} = 16 \text{ cm}^2$$

$$A2 = 4 \text{ cm} \times 4 \text{ cm} = 16 \text{ cm}^2$$

$$A3 = 4 \text{ cm} \times 3 \text{ cm} = 12 \text{ cm}^2$$

$$A4 = 4 \text{ cm} \times 3 \text{ cm} = 12 \text{ cm}^2$$

$$A5 = 4 \text{ cm} \times 3 \text{ cm} = 12 \text{ cm}^2$$

$$A6 = 4 \text{ cm} \times 3 \text{ cm} = 12 \text{ cm}^2$$

$$\text{Total surface area} = 16\text{cm}^2 + 16\text{cm}^2 + 12\text{cm}^2 + 12\text{cm}^2 + 12\text{cm}^2 + 12\text{cm}^2$$

$$\text{Total surface area} = \mathbf{80 \text{ cm}^2}$$

6. Find the volume of the box.

$$\text{Volume} = \text{length} \times \text{width} \times \text{height}$$

$$= 4\text{cm} \times 3\text{cm} \times 4 \text{ cm}$$

$$= \mathbf{48 \text{ cm}^3}$$