# Performance Based Learning and Assessment Task

## *Swimming Pool Dilemma*

**I. ASSESSSMENT TASK OVERVIEW & PURPOSE:**
The student will take the knowledge volumes of three-dimensional solids and apply it to a real-life situation.

**II. UNIT AUTHOR:**
Sallie Shackelford, Rappahannock County High School, Rappahannock County Public Schools

**III. COURSE:**
Geometry

**IV. CONTENT STRAND:**
Geometry

**V. OBJECTIVES:**
Volume of 3D solids

**VI. REFERENCE/RESOURCE MATERIALS:**
calculators, computers

**VII. PRIMARY ASSESSMENT STRATEGIES:**
The student will be assessed using a scoring rubric. (See Attached)

**VIII. EVALUATION CRITERIA:**
Scoring rubric and benchmark of exemplary work attached

**IX. INSTRUCTIONAL TIME:**
One 90-minute period

# Swimming Pool Dilemma

**Strand**
Geometry

**Mathematical Objective(s)**
Volume of three-dimensional solids

**Related SOL** G.13 The student will use formulas for surface area and volume of three-dimensional objects to solve real-world problems.

**NCTM Standards**
- Apply and adapt a variety of appropriate strategies to solve problems
- Communicate mathematical thinking coherently and clearly to peers, teachers, and others

**Materials/Resources**
Calculators (if needed for basic calculations)
Computers for research on gallon conversions

**Assumption of Prior Knowledge**
- Students should have discussed volume of three-dimensional objects.

## Introduction: Setting Up the Mathematical Task

- Abby and Tom each want to put a swimming pool in their back yards. They both have requested you and your partner, the pool designers, to design a pool for each of them that will hold very close to the same amount of water. However, they do not want their pools to be the same shape. You must provide both Abby and Tom with the name of the shape of their pool, a sketch of their pool, the dimensions, and the amount of water their pool will hold (in gallons).
- In this task, you will apply the knowledge learned about volume of three-dimensional solids to a real-world situation dealing with swimming pools.

## Student Exploration

### Student/Teacher Actions:

- Students will individually analyze the scenario given. Then, they will pair up with another student in the class. Each pair of students will discuss with each other strategies to solve the given problem.
- The teacher should check on each pair of students to make sure they are on task.

- If any students are struggling, the teacher should ask the students leading questions, such as "What kind of shapes can a swimming pool be (2D or 3D)?" or "What does the problem want us to find when it says 'How much water can the pool hold'?"
- Students will work as pairs to solve the problem given.

**Monitoring Student Responses**

- Students will share their designs with the whole group at the end of the class.

## Assessment List

| | | Points Earned | |
|---|---|---|---|
| Element | Point Value | Self | Teacher |
| Mathematical procedures are correct. | 2 | | |
| The formulas used are clearly written. | 2 | | |
| Mathematical calculations are correct. | 2 | | |
| Work is shown neatly. | 2 | | |
| The names of the shapes of the swimming pools are given. | 2 | | |
| A sketch is provided. | 2 | | |
| Correct dimensions are given. | 2 | | |
| The amount of water the pool will hold is given in gallons. | 2 | | |
| The amount of water the pool will hold is very close for both pools. | 2 | | |
| Both partners worked together to solve this problem. | 2 | | |

| # | **Element** | **0** | **1** | **2** |
|---|---|---|---|---|
| 1 | Mathematical procedures are correct. | No procedures are correct | Half of procedures are correct | All procedures are correct |
| 2 | The formulas used are clearly written | No formulas are written or are not legible | The formulas written are not correct | The correct formulas are written and legible |
| 3 | Mathematical calculations are correct | No mathematical calculations are correct | There are only a few errors in the calculations | All mathematical calculations are correct |
| 4 | All work is shown neatly | No work is shown or is not legible | Only part of work is neatly shown | All work is shown neatly and is legible |
| 5 | The names of the shapes of the pools are given | Both names are wrong | Only one name is correct | Both names of the shapes are correct |
| 6 | A sketch is provided | Neither pool has a sketch provided | Only one pool has a sketch provided | Both pools have a sketch provided |
| 7 | Correct dimensions are given | No correct dimensions are given | Only one pool has correct dimensions given | Both pools have all correct dimensions given |
| 8 | The amount of water the pool will hold is given in gallons | Amounts for each pool is not given in gallons | Amount for only one pool is given in gallons | Amount for both pools is given in gallons |
| 9 | The amount of water the pool will hold is very close for both pools | Difference is greater than 20 gallons | Difference is 10-20 gallons | Difference is less than 10 gallons |
| 10 | Partners worked collaboratively | Only one partner did all the work | NA | Both partners worked together |

## Benchmark

Abby's pool will be an above ground cylindrical pool. The dimensions of Abby's pool will be diameter of 12 feet and a height of 3 feet. The amount of water that the pool will hold is based on the volume of the cylinder. Using the formula, $V = \pi r^2 h$, plug in Abby's radius and height $V = \pi(6^2)(3) = 108\pi \approx 339.29 ft^3$. Because the amount of water in pools is measured in gallons, I researched the conversion from cubic feet into gallons and found 1 cubic foot holds 7.48 gallons. I then used the proportion $\frac{339.29 ft^3}{x gal} = \frac{1 ft^3}{7.48\ gal}$ to find that the amount of water that Abby's pool will hold is 2537.89 gallons. Tom's pool will be an in-ground rectangular prism pool. To get Tom's pool to hold close to the same amount of water, I substituted Abby's volume into the formula $V = lwh$ which gave me$339.29 ft^3 = lwh$. I wanted the depth of the pool and width of the pool to be the same and the length of the pool to be double that measurement. Therefore, used $w$ as my variable and made $l = 2w$ and $h = w$. Plugging those into my formula it looks like this: $339.29 = (2w)(w)(w)$ which simplifies to $339.29 = 2w^3$. When I solved this formula, the dimensions for Tom's pool are w = 5.54 feet, h = 5.54 feet, and *l*=11.08 feet. The volume of Tom's pool is 340.06ft$^3$. Using the same ratio to convert into gallons, Tom's pool will hold 2543.65 gallons of water. The difference in the amount of water the pools will hold is 5.76 gallons.

1 ●——● = 2 feet