

Open-Ended Problem

Names:

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Grade Level: 6-8

Content Area: MEASUREMENT AND ESTIMATION

PA Standard(s) addressed:

2.3.8.A Develop formulas and procedures for determining measurements

2.3.8.D Estimate, use and describe measures of distance, rate, perimeter, area, volume, weight, mass and angles

2.3.8.F Use scale measurements to interpret maps and drawings

NCTM Standard(s) addressed:

MEASUREMENT

- Understand both metric and customary systems of measurement
- Understand relationships among units and convert from one unit to another within the same system
- Understand, select, and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume
- 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

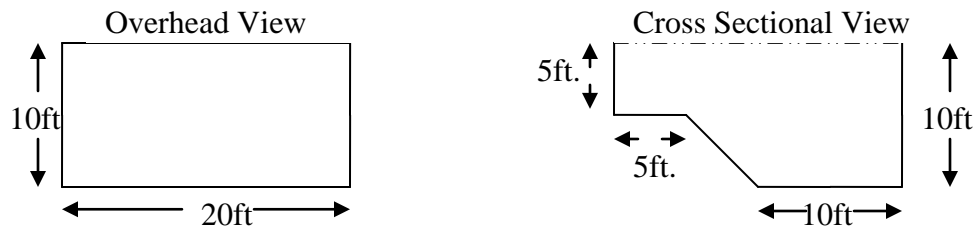
Problem Name:

Don and Eddie's Pool Party

Problem:

Don invited Eddie to a pool party at Frank's House. Don told Ed it was a BYOW (bring your own water) party. When Eddie comes to the party, how much water should Eddie bring to fill the pool?

Use the following diagram, drawn to scale, to calculate the capacity of the pool in gallons to the nearest tenth.



Directions:

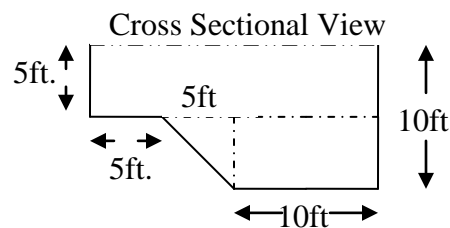
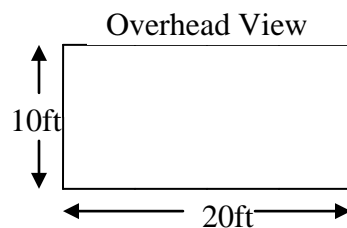
For full credit, you must do the following:

1. show OR describe each step of your work, even if you did it in your head ("mental math") or used in calculator,
AND
2. write an explanation stating the mathematical reasons(s) **why** you chose each of your steps.

Problem Solution(s):

The pool is made of three distinct sections, two rectangular prisms (different dimensions), and one triangular prism. Therefore, the sum of the three sections will equal the volume of the entire pool in cubic feet.

1. To find the volume of the triangular prism, I found the measures of the two legs through inference. The volume of a triangular prism, $V = \frac{1}{2}lwh$, equals the product of the length times width times height divided by two. The volume of the triangular prism is $V = \frac{1}{2}(10 \text{ ft})(5 \text{ ft})(5 \text{ ft}) = 125\text{ft}^3$
2. To find the area of the larger rectangular prism, I found the measures of the missing measurement through inference. The volume of a rectangular prism, $B = lwh$, equals the product of the length times width times height. The volume of the larger rectangular prism is $V = (10 \text{ ft})(5 \text{ ft})(20 \text{ ft}) = 1000\text{ft}^3$
3. To find the area of the smaller rectangular prism, I found the measures of the missing measurement through inference. The volume of a rectangular prism, $B = lwh$, equals the product of the length times width times height. The volume of the smaller rectangular prism is $V = (10 \text{ ft})(10 \text{ ft})(5 \text{ ft}) = 500\text{ft}^3$
4. The volume of the entire swimming pool is the sum of the three above prisms. $V = 125\text{ft}^3 + 1000\text{ft}^3 + 500\text{ft}^3 = 1625 \text{ft}^3$
5. However, the solution is not complete. The answer should be given in gallons, not cubic feet. Therefore, a conversion is needed. To find the number of gallons equivalent to the number of cubic feet, the number of cubic feet is multiplied by 7.5 because 1 cubic feet = 7.5 gallons. The total number of gallons needed to fill this swimming pool is 12,187.5 gallons.



Mathematical Work:

1. Triangular Prism Volume: $V = \frac{1}{2}(10 \text{ ft})(5 \text{ ft})(5 \text{ ft}) = 125\text{ft}^3$
2. Larger Rectangular Prism Volume: $V = (10 \text{ ft})(5 \text{ ft})(20 \text{ ft}) = 1000\text{ft}^3$
3. Smaller Rectangular Prism Volume: $V = (10 \text{ ft})(10 \text{ ft})(5 \text{ ft}) = 500\text{ft}^3$
4. Total Volume of Swimming Pool: $V = 125\text{ft}^3 + 1000\text{ft}^3 + 500\text{ft}^3 = 1625\text{ft}^3$
5. Conversion of Cubic Feet to Gallons: 1 cubic feet = 7.5 gallons
 $1625 \cdot 7.5 = 12187.5$ gallons

Therefore, Ed needs to bring 12187.5 gallons of water to fill Frank's pool.

Specific Rubric:**5. Advanced Understanding:**

- Correct answer with correct procedures/correct calculations shown or described and a written explanation that supports the work shown. The explanation tells what was done in the solution process and explains why the steps were done. May have a minor omission in calculation or explanation if trivial.
- Student dissects diagram in an appropriate manner.
- Student infers missing measurement.
- Student calculates volume of each section correctly.
- Student calculates total volume in cubic feet.
- Student converts cubic feet to gallons.

4. Satisfactory Understanding:

- Correct answer with all or most correct procedures/calculations shown OR described AND some explanation.

3. Almost Satisfactory Understanding:

- Correct answer with most correct procedures/calculations shown OR described AND no explanation.
- Correct answer with few correct procedures/calculations shown OR described AND some explanation.
- Incorrect answer with all correct procedures shown OR described AND some explanation but with one calculation or copying error carried through.

2. Partial Understanding:

- Correct answer with few correct procedures/calculations shown OR described AND some or no explanation.
- Incorrect answer with half or more correct procedures/calculations shown OR described AND some or no explanation. Student either did not proceed far enough or proceeded incorrectly.
- Incorrect answer with all correct procedures shown OR described AND no explanation but with no more than two calculation or copying errors carried through.

1. Minimal Understanding:

- Correct answer with calculations, procedures, or explanation that are either not legible, not understandable, or missing or procedure is incorrect.
- No answer or an incorrect answer, but the student has provided some of the information critical to the solution. There is some indication that the student has read the problem.

0. No Understanding:

- Incorrect answer with no correct procedures, calculations, or explanation shown or described.
- Question marks, "I don't know" or a written "Absent" on the response page. (Student has read or seen the problem.)