

MEASURING AND CALCULATING THE VOLUME OF A ROOM

Performance Standards (7A/7B).H

Each student will measure the dimensions of a bedroom at a building trades home or a new home being built by a local builder (the classroom may be used if homes are unavailable). They will calculate the volume of the bedroom and determine the maximum error present in their distance measurements and in their calculated volume:

- *Mathematical knowledge:* measure to the greatest degree of accuracy and compute volume; determine the maximum error based on measurements and tools.
- *Strategic knowledge:* determine greatest degree of accuracy and solve problem using a systematic process.
- *Explanation:* explain completely what was done and why it was done.

Procedures

1. *In order to measure and compare quantities using appropriate units, instruments and methods (7A) and estimate measurements and determine acceptable levels of accuracy (7B),* provide students with sufficient learning opportunities to develop the following:

- Determine derived measurements.
- Measure any quantity to the greatest degree of accuracy determined by the tool.
- Determine the maximum error in measurements.

Heat gain or loss in a room is a critical component of determining proper heating and air conditioning installations. This process is begun by determining the volume of a room. This assessment aligns with Workplace Skills H3 (Solving Problems and Critical Thinking/Identify solutions to a problem), H4 (Solving Problems and Critical Thinking/Employ reasoning skills) and H7 (Solving Problems and Critical Thinking/Select and implement a solution to a problem.)

2. Provide students with the assessment task sheet.

Use the measurement tools provided by your teacher to measure a bedroom in the building trades home or a new home being built by a local builder and determine its volume. You will need to decide what measurements to make and be as accurate as possible using the tools provided. Explain the procedures you used and how you obtained your results. Discuss the error present in each of your measurements. Discuss the maximum error present in your calculated value for area.

Have students work with a partner to make measurements. Each person should write up his or her results and calculations separately. Provide the students with any convenient type of measurement tool you have available. Thirty-foot, 50-foot or 100-foot measuring tapes would be best. Calculators may be used.

3. Use the standard scoring rubric. Give each student a score in each of the three categories. A score of 4 should indicate completely correct solutions to all parts of the problem, with complete and correct justifications of their reasoning. A 3 should represent correct or nearly correct solutions to all parts, with only minor computational errors making their solutions inaccurate; their rationale should be sound but may not be completely explained. A 2 would indicate that students have some idea about how to answer the questions but make major errors in computation and or reasoning that affect their answers. A 1 may have a correct answer for one part but generally shows little understanding in their rationale for their procedures and processes. A score of 0 generally reflects no correct responses and no logical rationale for their procedures and processes.
4. Minor errors in computation include making errors in the actual addition or multiplication or rounding incorrectly. Major errors include using the wrong operations or formulas to relate terms.
5. Each room measured will have slightly different dimensions and shapes. Students should make sure that they account for any deviations from the general rectangular shape of the room. When judging the correctness of the student work, you should check the accuracy of their measurements and their calculations. Make sure their reporting of measurements matches the accuracy possible with the tool they used. For instance, if a measuring tape is marked in eighths of an inch, then their measurements should be accurate to the nearest eighth of an inch. They should not round measures to the nearest whole inch. Also if that same measuring tape were used, then the error in each measurement would be plus or minus a sixteenth of an inch, since anything between the markings would be simply rounded up or down; and we assume the measurement is rounded to the nearest marked unit. The calculation of volume involves multiplication of length times width times height, and thus the error will be multiplied as well. One way to calculate this error is to calculate the volume using the largest actual values for each distance measure (that is if the measured amount has been rounded down the sixteenth of

an inch), and then calculate the area using the smallest actual values that could have been possible. The difference in the two areas is the greatest error possible based on your measurements and tools.

Examples of Student Work

- [Meets](#)
- [Exceeds](#)

Time Requirements

- Students should be allowed 10-15 minutes to complete their actual measurements
- The students should then be provided another 15-20 minutes to complete their calculations of volume and write up their solutions

Resources

- Copies of the “Measuring and Calculating the Volume of a Room” student task sheet
- Writing utensil
- Calculators
- 30-foot, 50-foot or 100-foot measuring tapes
- Mathematics Rubric

NAME _____ DATE _____

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Student Task Sheet

1. Use the measurement tools provided by your teacher to measure a bedroom in a building trades home or a new home being built by a local builder and determine its volume. You will need to decide what measurements to make and be as accurate as possible using the tools provided. Explain the procedures you used and how you obtained your results.
2. Discuss the error present in each of your measurements.
3. Discuss the maximum error present in your calculated value for volume.

MATHEMATICS RUBRIC

NAME _____ DATE _____

- Exceeds standard (must receive a 4 in each area)
- Meets standard (must receive all 3's or a combination of 3's and 4's)
- Approaches standard (must receive all 2's or any combination which may include a 3 or a 4)
- Begins standard (has no 3's or 4's but not all 1's)
- Absent (has all 1's and 0's)

	Mathematical Knowledge	Strategic Knowledge	Explanation
4	<ul style="list-style-type: none"> • Wrote the right answer. • Used math words correctly to show understanding of how math works. • Worked it out with no mistakes. • Used the right math words and labeled the answers. 	<ul style="list-style-type: none"> • Identified all the important parts of the problem, and knew how they went together. • Showed all the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote what was done and why it was done. • If a drawing was used, all of it was explained in writing.
3	<ul style="list-style-type: none"> • Knew how to do the problem, but made small mistakes. 	<ul style="list-style-type: none"> • Identified most of the important parts of the problem. • Showed most of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote mostly about what was done. • Wrote a little about why it was done. • If a drawing was used most of it was explained in writing.
2	<ul style="list-style-type: none"> • Understood a little, but made a lot of big mistakes. 	<ul style="list-style-type: none"> • Identified some of the important parts of the problem. • Showed some of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote some about what was done or why it was done but not both. • If a drawing was used, some of it was explained in writing.
1	<ul style="list-style-type: none"> • Tried to do the problem, but didn't understand it. 	<ul style="list-style-type: none"> • Identified almost no important parts of the problem. • Showed almost none of the steps used to solve the problem. 	<ul style="list-style-type: none"> • Wrote or drew something that didn't go with the answer. • Wrote an answer that was not clear.
0	<ul style="list-style-type: none"> • No answer attempted. 	<ul style="list-style-type: none"> • No strategy shown. 	<ul style="list-style-type: none"> • No written explanation.
Score			