



Area Contractor

This lesson gives students the opportunity to explore surface area in the same way that a contractor might when providing an estimate to a potential customer. Once the customer accepts the estimate, a more detailed measurement is taken and a quote prepared. In this lesson, students use estimation to determine the surface area of the walls and floor of their classroom. They check the reasonableness of their estimates, and then measure the classroom for accuracy.

Learning Objectives

Students will:

- Estimate area of walls and floor using reference items or points in a room
- Estimate area of windows, doors, and any obstructions that cannot be moved or that the customer does not want moved
- Estimate net surface area of walls and floor by subtracting the area of any obstructions from the appropriate wall or floor gross estimate
- Calculate actual gross surface area of walls and floor using a tape measure, within ± 1 inch tolerance (or as determined by you)
- Determine net surface area of walls and floor through actual measurement of surface area less any obstructions such as chalkboards, cabinets, windows, doors, etc., within a tolerance determined by you

Materials

Measuring tape (1 per group; tapes 25 feet or longer provide the best accuracy)

Chart paper and markers

[Area Contractor Activity Sheet](#)

Instructional Plan

This lesson has two parts. The first part involves estimation of area, and the second part involves actually measuring the area for accuracy. The parts can be completed separately, or students can be given all the information up front and allowed to work at their own pace.

To prepare for the estimated area activity, you may want to measure ahead of time various items in your classroom that you could suggest to students as measurement

reference points. The [Area Contractor](#) Activity Sheet is set up to include a typical classroom with 4 walls and standard obstructions. Modifications may necessary for rooms with a different number of walls or unique architecture.



[Area Contractor Activity Sheet](#)

Divide students into groups of three and assign roles. Each group member should be assigned a task role and a measurement role, as outlined on the activity sheet. This lesson lends itself to differentiated instruction through group role assignments (see discussion below). Groups will indicate their assigned roles on their activity sheets by circling their role titles.

Part 1: Estimation

Each group must first estimate the surface area of the classroom walls and floor using reference points found in the classroom. If students are not familiar with estimating measurements using reference points, you may want to consider the following questions as a way to access prior knowledge or help identify potential reference points in your classroom:

- What is the difference between estimation of area and actual area?

[Estimation is based on visual inspection and reference points. For example, to estimate the area of a wall, use visual inspection to count the number of concrete blocks, 8" by 16". Actual area requires the use of a tape measure with accuracy within prescribed tolerances.]

- What reference points in the room could you use to estimate the gross square footage of the ceiling, walls, and floor of the classroom?

[Standard door height is 80" or 6'8". Concrete (cinder) blocks are 8" by 16". Floor tiles are typically 12" square. Other reference points might include bookcases, counter tops, desks, and students' physical height.]

During the estimation phase, actual measuring instruments are not to be used. Estimations are to be checked by each member of the group for reasonableness before proceeding with actual measurements. While students work on their estimations, you might want to consider posing one or more of the following questions to group members:

- What reference points did you use to derive your estimate?

[Reference points that students might choose could include their personal heights, bookcases, desks, bricks, doors, or windows. Some doors have height labeled, so they may choose those.]

- Why did you choose these reference points?

[Most students will tell you that they “know those measurements” or it just makes sense to them. Be prepared for some creativity.]

- How close do you think your estimate is to the actual measurement? Why do you think this?

[The majority of students will be over on their estimates, which is a reasonable result. When asked why, they will tell you they either guessed or rounded up. If their measurements are under, the typical explanation is that they could not reach. Estimates can also be under the actual measurements if students did not properly convert their units between inches and feet.]

Part 2: Accurate Measurement

It is important that students know how to properly use and read a tape measure. If students are completing both parts of this lesson at their own pace, you may want to instruct them on how to use the tape measure before they begin Part 1, the estimation activity. If all groups start Part 2 at the same time, it would be better to instruct students on how to use the tape immediately before the accurate measurement activity.

Each person in a group will use the measuring tapes provided to measure the surface area of one or more classroom walls and floor for accuracy. Measurements are to be reviewed by each member of the group for reasonableness. If there is a question of reasonableness, then the surface in question should be measured again by a different group member. If time permits, have someone else within the group verify all measurements for accuracy. As students work on collecting their actual measurements, consider asking group members one or more of the following questions:

- How close were you to your original estimate? What might have accounted for the difference?

[Answers will vary regarding closeness. Many differences tend to be from conversion between inches and feet, recording measurements incorrectly, or not paying attention to detail.]

- If you were going to paint this wall, do you think it is important to actually measure it or would an estimate be good enough?

[Most students will tell you that an estimate is good enough, and if they ran out of paint they would just buy more. This is true for many do-it-yourself projects, but if a contractor had to buy more paint, he/she would lose money. A contractor would have first bid on the job for a specific number of hours and amount of paint. If it takes longer or takes more paint, it costs the contractor, not the customer, more money.]

Have groups prepare a presentation to the class comparing their estimates to their actual measurements. Presentations should include the methods the group used for their estimates and a discussion of why there is a difference between the estimate and the actual measurement. Once all groups have presented their findings, consider a whole-group discussion using one or more of the *Questions for Students*.

Differentiated Instruction

This activity can be used with differentiated instruction and mixed-ability groups. Each student within a group will have an assigned role. You or the group members can make these assignments. If you assign the specific roles within a group, consider doing so based on the students' ability levels.

Level 1 – The Novice of the group should be assigned the responsibility of measuring the wall with minimal obstructions.

Level 2 – The Apprentice should have proven skills in estimating and measuring area. The apprentice should be assigned the responsibility of measuring the wall with simple obstructions, such as the chalkboard.

Level 3 – The Expert should be assigned the task of determining the net surface area of walls with complex obstructions. Complex obstructions may include multiple windows, doors, or cabinets.

Questions for Students

- If you were the customer, would you want your contractor to overstate or understate the estimate? Which would be better if you were the contractor? Why?

[From both the customer's and the contractor's perspective it is

better to overestimate than to underestimate. The contractor could lose money on the job if the cost comes out higher than the estimate. The customer may feel misled if the final cost is higher than the estimate. However, contractors need to take care that they do not grossly overestimate the cost because they may scare their potential customer off.]

- What are some situations in which an estimate is usually sufficient?

[Answers will vary but may include distance, value of the contents of a shopping cart, cost of a meal when eating out, etc.]

- Describe a situation where precision is critical.

[Answers will vary. A good example to get students talking is the fabrication of an airplane. Would they want to fly in a plane were the parts were not measured with precision? In any situation where integrity of the construction could mean the difference between life and death or injury, precision is critical.]

Assessment Options

1. Collect the completed activity sheets.
2. Have students present their results to the class.
3. Have groups prepare a written report of their findings that includes a description of the mathematics used to justify their estimates.
4. Consider having students repeat this activity for a room in their home. This could also be a family-night assignment that encourages other family members to participate.

Extensions

1. Groups can compete for accuracy of estimates without being under. As well, as part of the opener for Part 2, let students know that bonus points will be awarded for the most accurate measurement. Note: In order to offer this extension, you will need accurate measurements of the classroom before starting this lesson. Your school's building engineer may have that information available.
2. Add additional elements to the estimation task, such as the ceiling and any trim.
3. Invite a guest speaker to talk about the process of providing estimates.
4. Consider asking your building engineer to come in and present the estimate

request to your students.

Teacher Reflection

- Did students have sufficient knowledge of estimation to work on this activity independently within their groups?
- Did students experience difficulties with using the measuring tapes? If so, what could be done to make it easier for them?
- If you used ability grouping or differentiation, were the results positive or negative? Why? What would you do differently next time?
- Do you feel that group dynamics were important in this activity? Why?
- If time was a constraint for this activity, what would you change?
- Were concepts presented too abstractly? too concretely? How would you change them?
- What were some of the ways in which students showed that they were actively engaged in the learning process?
- Did you find it necessary to make adjustments while teaching the lesson? If so, what adjustments? Were these adjustments effective?
- What worked with respect to classroom behavior management? What didn't work? How would you change what didn't work?

NCTM Standards and Expectations

Measurement 6-8

1. Use common benchmarks to select appropriate methods for estimating measurements.
2. Select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision.



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