

I. Title of Project: Clubhouse Contractor

II. Team Members: Brian Long
Laurie Maglietta
Scott Sprengel

III. Grade Level: Fifth Grade

IV. Concepts Used: Estimation with regard to money, tools and units of measurement, real world problem solving strategies, geometric concepts of solids and surface area.

V. PA Standard(s) Addressed: Grade 5

Mathematics standards

2.2.5.G Apply estimation strategies to a variety of problems including time and money

2.3.5.A Select and use appropriate instruments and units for measuring quantities (e.g., perimeter, volume, area, weight, time, temperature).

2.3.5.B Select and use standard tools to measure the size of figures with specified accuracy, including length, width, perimeter and area.

2.5.5.A Develop a plan to analyze a problem, identify the information needed to solve the problem, carry out the plan, check whether an answer makes sense and explain how the problem was solved

2.9.5.J Define the basic properties of squares, pyramids, parallelograms, quadrilaterals, trapezoids, polygons, rectangles, rhombi, circles, triangles, cubes, prisms, spheres and cylinders.

2.9.5.E Construct two- and three-dimensional shapes and figures using manipulatives, geoboards and computer software.

2.4.5.A Compare quantities and magnitudes of numbers.

Reading standards

1.6.5. E Participate in small and large group discussions and presentations.

VI. NCTM Standard(s) Addressed: Grades 3-5

Number and Operations standards

Understand meanings of operations and how they relate to one another:

- Understand the effects of multiplying and dividing whole numbers

Compute fluently and make reasonable estimates:

- Select appropriate methods and tools for computing with whole numbers from among mental computation, estimation, calculators, and paper and pencil according to the context and nature of the computation and use the selected method or tool

Geometry standards

Use visualization, spatial reasoning, and geometric modeling to solve problems:

- Build and draw geometric objects
- Identify and build a three-dimensional object from a two-dimensional representation of that object

Measurement standards

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

- Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles
- Develop, understand, and use formulas to find the area of rectangles and related triangles and parallelograms
- Develop strategies to determine the surface areas and volumes of rectangular solids

Problem solving

- Solve problem that arise in mathematics and in other contexts

Communication

- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others

Connections

- Recognize and use connections among mathematical ideas

VII. Introduction / Applications:

Given a scenario of constructing a scale clubhouse model, the students will design and assemble the necessary templates to given specifications. Next, the students will calculate the model's surface area and project the appropriate costs for a full-scale structure.

VIII. Question:

What is the cost to construct a clubhouse from a scale model composed of two geometric solids designed to accommodate a specific number of occupants?

IX. Prerequisites:

Students will have been taught the following concepts prior to the teacher facilitating this project:

- Surface area of geometric solids
- Knowledge of two and three-dimensional shapes

X. Resources and Materials:

Standard classroom items for each team of 2-4 students:

- Compass
- Ruler (US Customary and/or metric)
- Craft glue
- Clear tape
- Scissors
- Pencil
- Calculator (optional)
- Card stock printed with grid (see attachment)
- Student Requirement sheet (see attachment)

additionally

- Craft foam = \$2.50 per team

XI. Procedures & Activities:

1. Prepare card stock by printing the grid attachment and copying the grid onto card stock.
2. Explain to the students that they will design a clubhouse and construct a model composed of two geometric solids designed to accommodate a specific number of occupants.
3. Distribute a direction sheet to the students which contains the parameters of the project: The clubhouse must accommodate anywhere from 3-20 club members with 9 ft.² of floor space per occupant; the total floor area must be a *perfect square*; use 2 geometric solids to form the room and the roof area of the clubhouse – the students may choose from two geometric solids for the base (cube or rectangular prism) and two geometric solids for the roof (*triangular prism* which must have two *equilateral* triangles or a *square pyramid*); and the base of the roof must be *congruent* to the base of the room; walls of the room must be 6 feet in height.
4. Students decide how many club members they will have, create the perfect square, select which geometric solids to use, and use the graph paper to draw the *faces* of the two geometric solids. Students should then calculate the *surface area* of each face and write the calculated area on the inside of each face.
5. Students should cut out and tape together the graph paper solids to check their measurements. If they are satisfied with their patterns, the pattern should be disassembled and traced onto the craft foam. Cut out the foam faces and glue together to form the two geometric solids.
6. Finally, using the given cost of plywood per square foot, students should calculate the total cost of building their clubhouse.

XIII. Answers / Rubric:

Level 5

- Model correct (2 solid figures, built to scale)
- Correct calculations (surface area, cost) – work shown
- No errors

Level 4

- Model correct (2 solid figures, built to scale)
- Correct calculations (surface area, cost) – work shown
- Minor omission in calculations

Level 3

- Model correct (2 solid figures, built to scale)
 - Most calculations (surface area, cost) – work shown
 - Some steps missing, but can follow what was done
- OR
- Incorrect answers (surface area or cost) due to an error in calculation
 - Model not built to scale due to error in one or more of the figures

Level 2

- Model correct (2 figures, built to scale)
 - Few calculations (surface area, cost) shown
 - Many steps missing or not in order – cannot follow what was done
- OR
- Incorrect answers (surface area or cost)
 - At least half of work is shown
 - Some or no explanations

Level 1

- Model partly correct (at least one of the solid figures built to scale)
 - Calculations not readable or understandable
 - Some steps presents
- OR
- No answers/Incorrect answers (surface area, cost)
 - Some information related to the task

Level 0

- Model incorrect
- No calculations (surface area, cost) shown
- No information related to task
- Blank

XIV. Accommodations/Adaptations:

ESL: Student needs to be with team members who are proficient in English. Teacher will provide individual assistance as needed.

Special Needs: First and foremost, the teacher will need to collect all pertinent data that relates to the specific child's IEP and make accommodations as such. This student should be on a team that consists of one or more students with strengths in mathematical concepts relating to this project. Teacher should provide individual assistance as needed.

Enrichment: Consider that the sheets of plywood only come in 4 X 8 sheets. How many sheets of plywood will need to be purchased in order to construct the final clubhouse?

Clubhouse Contractor!

You are going to design a clubhouse composed of two geometric solids for you and a select group of your friends! Then, you will calculate the surface area of each solid and the cost of the materials to build your clubhouse.

Here are the requirements for your clubhouse:

- It must accommodate 3-20 club members.
- Each member requires 9 ft.² of floor **area**
- The total floor area must be a **perfect square**.
- You will have a room and a roof structure. You will select one geometric solid for the room and one geometric solid for the roof structure from the following:

Room – cube **OR** rectangular prism

Roof – square pyramid **OR** triangular prism

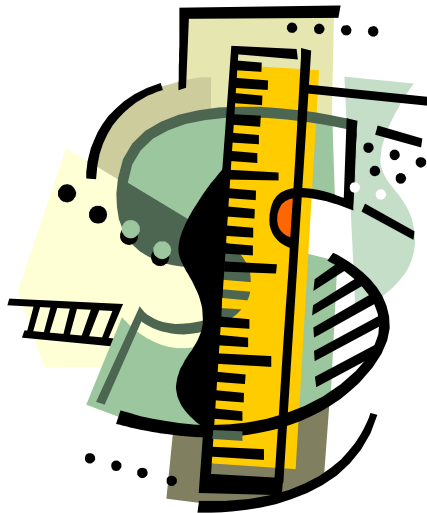
Note: If you choose a triangular prism for the roof, the **congruent** triangles must be **equilateral**.

- The base of the geometric solid you choose for your roof must be **congruent** to the top of the geometric solid you choose for your room.
- The walls of your room must be 6 ft. in height.



As you design and build your clubhouse, keep in mind the following:

- design your clubhouse using the U.S. customary units of *feet*
- construct your initial *scale model* using the graph paper provided, where one *centimeter* on the graph paper represents one *foot* in your clubhouse
- using the *faces* from your initial scale model as *templates*, construct your final scale model using the craft foam provided
- calculate the *surface area* for each face of your two geometric solids in square feet
- calculate the *cost* of materials to build your clubhouse (1 ft.² of plywood = \$0.63)



Grid Template scale: 1 cm = 1 ft.

