Performance Based Learning and Assessment Task

Activity/Task Title

I. **ASSESSMENT TASK OVERVIEW & PURPOSE:**

The student is contracted to design the most effective floor plan for a Beach House within a budge. Working in groups they will calculate the area within a square footage limit and the cost of materials for the project and present their ideas to the homeowners.

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III. **COURSE:** Geometry

IV. **CONTENT STRAND:** Measurement

V. **OBJECTIVES:**

Students will design a layout for their beach house that must not exceed $3,500 in flooring costs.

Students will use area formulas to determine the total square footage of their design. They may use the following two dimensional shapes: square and rectangle.

Students will need to convert their units to both metric (meters) and standard (feet).

Students will calculate the cost of their project by researching the cost of different materials (wood, carpet, and tile).

VI. **REFERENCE/RESOURCE MATERIALS:**

Calculator, Paper, Pencil, Smartboard, Document Camera to display problem, computer for research

VII. **PRIMARY ASSESSMENT STRATEGIES:**

Teacher will use a student self-check list and an overall rubric to assess student and group learning. The teacher will be looking for complete and accurate calculations for the square footage and cost of materials. They will be assessing the students' understanding of how to calculate the area of a composite shape. Students should be able to explain why they chose their layout, how they came up with their calculations, and why they chose a certain flooring. Their presentation should be near, clear, and professional.

VIII.   EVALUATION CRITERIA:

Students will be evaluated on their successful completion of the activity in reference to the rubrics. They will be able to earn up to 16 points for the individual self-check rubric by averaging of their score with the teachers. They will also be able to earn another 16 points based on their overall group evaluation of their documented work and presentation.

IX.   INSTRUCTIONAL TIME:

Two-Three hours

Activity/Task Title

Strand: Geometry

Mathematical Goals and Objective(s)

Students will calculate the area of their house using different sized squares and rectangles. They will find the total square footage of the entire composite shape. The student should be able to figure out the best possible layout within the budget of $3,600 for flooring. They will also calculate the cost of materials based on their research of wood, carpet, and tile prices.

Related SOL

- o Grade Six – (6.10c) - Solve practical problems involving area and perimeter; and
- o Grade Six – (6.7c) - The student will solve single-step and multistep practical problems involving addition, subtraction, multiplication, and division of decimals.

NCTM Standards List all applicable NCTM standards related to each task/activity. Example:
- Apply and adapt a variety of appropriate strategies to solve problems
- Understand ratio concepts and use ratio reasoning to solve problems.
- Solve real-world and mathematical problems involving area, surface area, and volume.
- Draw, construct and describe geometrical figures and describe the relationships between them.

Materials/Resources

Calculators, Paper, Pencils, Smartboard, Document Camera to display problem, Computers

Assumption of Prior Knowledge

- Students are expected to know how to perform basic mathematical operations using measurements; basic shapes and area formulas of squares and rectangles; be familiar with scaled drawings and blueprints.

- The typical background should include calculating areas of squares and rectangles, not just separately but by sectioning off larger shapes into smaller known shapes. Students should be at least Van Hiele level 2.

- Students might begin to express concern about the idea of how to calculate the areas of polygon. Students will begin to use language such as cost per/"dimensions" or the "meters squared".

- Students should know how to convert between units of measure (Non-SI to Metric).

Misconceptions and difficulties:

- Students may find it difficult to decompose and recompose the area of shapes.

- Students may have trouble converting units between standard and metric.

- Students may not realize until they calculate the flooring costs that the square footage of their layout is too much.

What relevant contexts are drawn on in relation to this concept?

The idea of contracting companies charging certain amounts for materials and other fees restrict the amount a person can to spend on materials when working within a budget. Students might have difficulty realizing that material costs aren't the only factor when hiring contractors.

Introduction: Setting Up the Mathematical Task

- "In this task/activity, you will investigate the best possible floor design for a Beach House."
- The task at hand is to theoretically design a blueprint or layout for a Beach House within a budget and limit on square footage.
- Students will turn in a rough draft. Teacher will comment and give suggestions based on that draft. Two weeks later, students will turn in final draft of the project.
- To begin thinking about the task the teacher will ask students how to calculate the areas of different sized rooms and then oddly shaped rooms. The teacher will also ask students how to convert between meters and feet.
- Students will work together in partners to calculate the areas of different sized rooms.
- The pairing activity will work for students to see the objectives of the project. Students will also research different flooring layouts to see how they can efficiently use their space.
- The teacher will have students think about different possibilities in their lives where they may have wanted something in their rooms or homes to be renovated and a possibility of hiring a contractor to do the work (this is all theoretical, of course). It could be a tree house or possibly a dollhouse.
- To understand the task, the teacher will go through the example of a square room and calculating the area.
- Students will research and calculate cost of flooring materials between wood, carpet, and tile using Lowes or Home Depot websites.
- Students will create a physical model and presentation to display their findings and calculations of the project.

Student Exploration

Whole Class Sharing/Discussion: This will happen in the introduction stage of the project.

Small Group Work (if relevant)*:* Students will work with their group to discuss ideas for their blueprint of their Beach House. They will collaboratively choose the best layout and flooring for the budget. These ideas should be combined into a summative presentation.

Individual Work: Students will work individually to calculate the areas of different rectangles and squares and research cost of different floorings. They will construct a model and presentation. They can choose their presentation format (Prezi, PowerPoint, Voicethread, etc.).

Student/Teacher Actions:
- What should students be doing?
    - Students should be suggesting areas formulas during the introduction. Students should discuss ideas for their own blueprint with their partners/small group. They should be questioning their partner/group members on how their design might work, researching alternate designs, and looking for flaws in their design/ways to improve them. They will be working on their own calculations and developing their letters to their contractors. They will be adjusting their drafts after teacher feedback to finalize their work and presentation.

- What should teachers be doing to facilitate learning?
  The teacher should be introducing the project and asking the students how they can decompose a composite figure. The teacher should be encouraging research and discussion on different layouts. He/she should be checking calculations by circulating the room during project work time. He/she may show a student problem at the beginning of the class to do an error analysis of a common error that they may have noticed.

- Include possible solutions to the exploration, possible questions to pose to promote student thinking, possible misconceptions or errors, and possible questions to address those misconceptions or errors.

  Ask students about how certain designs may be enticing but they may not be the most cost efficient overall and have them explain why this may be the case.

- Include ideas for technology integration or cooperative/collaborative learning within the student/teacher actions.

  Technology may be integrated by the way they present the projects (i.e. Power Point, Prezi, Voicethread etc.). Also, students will conduct research on other possible layouts to see how the process works. They will be able to use Edmodo (or other Class Website) to post any questions they come across during the process.

Monitoring Student Responses

- Students will present their findings in a model and presentation through a Power Point, Prezi, Voicethread, etc.

- Students are expected to work not only in class but outside of class time, as well.

- Students are expected to discuss layouts and determine what would be the most efficient way to use the space.

- Students will use mathematical language when describing the area, such as: squared, multiply, length, width, total, sum, subtracting, missing measurement, equal etc.

- The teacher will be looking for accurate calculations including correct units and measurements. They will also be looking for different ways to decompose their figures making sure they are labeling the missing measurements correctly.

- Students who have difficulties will be addressed by giving extra guidance through mathematical computations.

- The teacher will extend students' thinking by asking them to calculate different shaped rooms other than rectangles and square flooring; possibly triangular, trapezoidal or circular shaped.

- A summary will occur in a presentation and letter to the contractor as the final products. The students will be presented with a complete rubric outlining what is expected of them.

    o There will be time given to provide feedback not only by the teacher but by their peers as well. Students are expected to grade their peers as well as themselves for self-evaluation purposes. Peer evaluations will be done using the same rubric provided to them by the teacher.

    o Student knowledge will be collected through their letter to the contractor as well as their presentations. Students will be asked questions either by peers or the teacher to also assessment knowledge.

Assessment List and Benchmarks
- Include Assessment List and Benchmarks (examples of excellent student work)
- Describe and attach the assessments for each task/activity objective.
    o **Questions**
        - How did you calculate the total area of the flooring?
        - How did you decide on your layout of the house?

    o **Journal/writing prompts**
        - If the room had been shaped differently (circle, oval, etc.), what calculations would need to be different?
        - How can you construct a model of your ideal Beach House?

- Accommodations will be given where needed. Students will be assisted in the calculations, assigned a partner, and/or students will be provided with a layout design. This could include limiting their square footage to $925 ft^2$ and developing the factors of that in order to help them get started with their outline of their layout.

Rubrics

Self-check Rubric

Number	Element	Point Value	Self-Graded	Teacher Graded
1	Layout includes minimum number of rooms	4		
2	Student shows all calculations	4		
3	Student is able to explain the steps needed to calculate the area of the composite shape	4		
4	Student's presentation is neat, clear, and professional	4		
		Total		
Comments:				

Group Rubric:

Element	Novice	Apprentice	Practitioner	Expert	Score
Layout with number of rooms	Layout does includes some of the minimum number of rooms	Layout includes most of the minimum number of rooms	Layout includes the minimum number of rooms	Layout includes more than the minimum number of rooms.	___/4
Calculations of area and cost	Work shows little to no calculations, or all calculations are incorrect, or costs are inaccurate	Work either shows all calculations with some incorrect or shows some calculations with all correct and/or some costs are accurate	Work shows correct calculations for most parts of the problem and/or most costs are accurate	Work shows correct calculations for all parts of the problem and costs are accurate	___/4
Explanation of calculations of composite shapes	Work provides no explanations, or all explanations are incorrect	Work provides some explanations, or explanations are incomplete	Work provides explanations for most of the answers	Work provides thorough explanations of all answers	___/4
Presentation	Work lacks neatness, clarity, and professionalism	Work needs improvement	Work is mostly neat, clear, and professional	Work is neat, clear, and professional	___/4
				Total	
Comments:					

Name: _____ Date: _____ Block: _____

Beach House

Mr. and Mrs. Smithsonian have decided to build a small beach home to visit in the summertime. Your group has been hired as the designers and contractors to design the layout and put in the flooring. Given the Smithsonian's budget, your group can only afford to buy flooring materials under the budget of $3,600.

As the designer, two of you will need to find the best layout that utilizes as much of the space as possible without going over the given size. You may use square and rectangular shaped rooms and you must include the following labeled rooms, but you are not limited to those. While the designers are working on the layout, two of you as the contractors must research and calculate the total cost of materials based on prices from Lowes or Home Depot. You may choose from wood, carpet, and tile. Lastly, you will need to present your group's model to the class as if you were presenting it to your clients, Mr. and Mrs. Smithsonian, using your choice in format. The format must be approved by the teacher (Ex: PowerPoint, Prezi, Voicethread, etc.).

Minimum rooms to include:

- master bedroom (must have one of the bathrooms attached)
- bathroom
- dining room (must be connected to the kitchen)
- kitchen (must be connected to the dining room)
- laundry room (must be connected to one of the bathrooms)
- living room

Name(s): _____ Date: _____ Block: _____

Beach House

Role: Designer(s)

Layout: Use the graph paper for a more accurate design.

_____

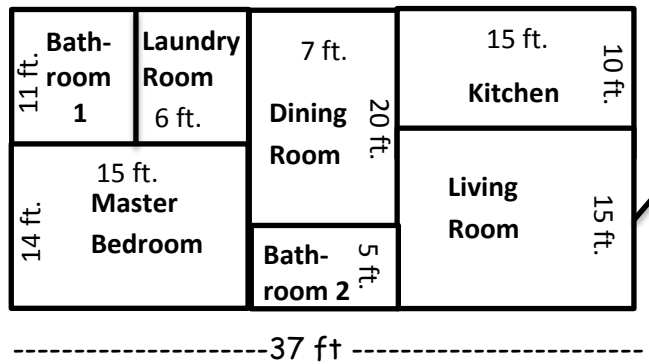Calculations:

Name(s): _____ Date: _____ Block: _____

Beach House

Layout:


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┌──────┬──────┬──────────┬──────────────────┐
│Bath- │Laundry│  7 ft.  │     15 ft.       │
│room  │Room  │          │     Kitchen   10 ft.│
│ 1  11 ft.│ 6 ft.│ Dining  20 ft.│                  │
│      │      │ Room     ├──────────────────┤
├──────┴──────┘          │   Living         │
│   15 ft.     ├─────────┤   Room    15 ft.│
│14 ft. Master │Bath-  5 ft.│                  │
│   Bedroom    │room 2  │                  │
└──────────────┴─────────┴──────────────────┘
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--------------------37 ft -----------------------

Calculations:

Room	Area
Master Bedroom	$A = l \times w$ $A = 15 \times 14 = 210 \text{ ft}^2$
Bathroom 1	$l = 15 - 6 = 9$ $A = l \times w$ $A = 9 \times 11 = 99 \text{ ft}^2$
Bathroom 2	$A = l \times w$ $A = 7 \times 5 = 35 \text{ ft}^2$
Dining Room	$A = l \times w$ $A = 7 \times 20 = 140 \text{ ft}^2$
Kitchen	$A = l \times w$ $A = 15 \times 10 = 150 \text{ ft}^2$
Laundry Room	$A = l \times w$ $A = 6 \times 11 = 66 \text{ ft}^2$
Living Room	$A = s^2$ $A = 15 \times 15 = 225 \text{ ft}^2$
total	$210 + 99 + 35 + 140 + 150 + 66 + 225 = 925 \text{ ft}^2$

US Standard Units	Metric Units
925 ft²	$\dfrac{3.28\,ft}{1\,m} = \dfrac{925}{x}$ $\dfrac{925}{3.28} = \dfrac{3.28x}{3.28}$ $282.01 \text{ m}^2 = x$

Beach House

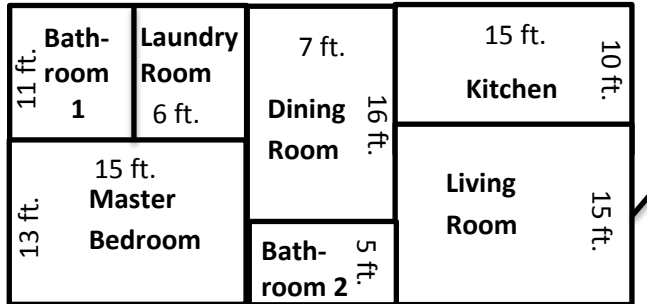*Role: Contractor(s)*

Layout: Use the graph paper for a more accurate design.

Cost Calculations:

Name(s): _____ Date: _____ Block: _____

Beach House

Layout:

Cost Calculations for Lowes for the example layout of an area of 1,882 ft^2:

Material	Cost/ft^2	Total Cost
Wood - Cali Bamboo 4.05-in W Prefinished Bamboo Hardwood Flooring	$3.99	925 x 3.99 = $3,690.75
Carpet - Stainmaster Active Family Gallery Cream Cut and Loop Indoor Carpet	$3.28	925 x 3.28 = $3,034.00
Tile - Style Selections Natural Timber Ash Glazed Porcelain Indoor/Outdoor Floor Tile	$3.88	925 x 3.88 = $3,589.00