

Project-Based Learning

A Perfect Home

**6th Grade
Mathematics**



A Perfect Home

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Mathematics

Overview

A home building nonprofit organization (e.g. Habitat for Humanity) is requesting home design submissions for their work in the local community and across the country.

Students will explore area and volume of 2D and 3D figures and unit conversions as they design their perfect home.

Students will demonstrate their understanding by communicating accountable content through the design requirement of a technical drawing with labels, measurements, and size calculations.

Guiding Questions

What strategies can you employ to model the area of unusual shapes?

How do you represent the area of rectangles, parallelograms, trapezoids, and triangles algebraically?

How do you represent the volume of right rectangular prisms algebraically?

How do you determine the area of rectangles, parallelograms, trapezoids, and triangles algebraically?

How do you determine the volume of right rectangular prisms algebraically?

How can you use proportions and unit rates to represent values in a different way?

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PBL Project Guide

Timeframe

This project will take approximately fourteen 50-minute class periods.

Step-by-Step Overview

- Introduce Launch Video.
- Introduce Entry Document.
- Facilitate Know/Need to Know activity.
- Students engage in an exploration activity.
- Groups brainstorm initial design products and assign roles/responsibilities.
- Groups alternate between facilitated content experiences and design time.
- During design time, groups integrate new content into design and re-evaluate product(s).
- Groups finalize product(s) and presentation.
- Groups present according to project guidelines.
- Content Debrief.
- Summative Assessment.

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PBL Resources

Project Resources

- Launch Video:
<https://youtu.be/ubrpPpzeEiY>
- Entry Document text
- Anticipated Knows/Need to Knows
- Strategies/considerations for implementation

Resources to Assemble/Prepare

You will need to prepare the following resource(s) ahead of time:

- Format Entry Document to local and nonprofit context
- Verify access to technology links
- Sample authentic products similar to project expectations
- Informational resources about area and volume of 2D and 3D objects and unit conversion

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Entry Event Guide

Launch Video

Time Lapse House Build - Knoxville Habitat for Humanity Blitz Build 2011:

<https://youtu.be/ubrpPpzeEiY>

Purpose: Engages students and introduces the topic of designing and constructing homes. Use video to solicit student responses to the following questions: *What items does Habitat for Humanity consider when designing and constructing a home for a family?*

Post student responses.

Entry Document

Format: *Request for Submissions* from a home building nonprofit organization. Edit document to include logistics such as a local community name, submission dates, and presentation requirements.

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Entry Event Guide *continued*

Entry Document

[HOME BUILDING NONPROFIT ORGANIZATION]

REQUEST FOR SUBMISSIONS

[NONPROFIT ORGANIZATION] is looking for the next big name in home design. Do you have what it takes to design a home? The perfect home for our families is affordable in cost, manageable in size, improves living conditions, brings together family members, and inspires hope for a better tomorrow.

We welcome submissions of designs for the next model we use when building homes in your community and others around the country. We will select the top design submitted. To add your design to the running, please complete the following:

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Entry Event Guide *continued*

Entry Document *continued*

- Technical drawing of the home
- Measurements of individual rooms and the home as a whole (include units)
- Calculations of room size and capacity

Please prepare a 3-minute presentation about your home design and why it should be selected for use by [NONPROFIT ORGANIZATION]. The submission items above and presentation are due [DUE DATE]. Additional consideration will be given to those who complete submissions for more than one design.

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What do we KNOW about the project?

Content

- Submission includes a technical drawing of a home
- Submission includes measurements of individual rooms
- Submission includes measurements of the whole house
- Measurements need to include units
- Submission includes calculations for room size and capacity

Product

- [NONPROFIT ORGANIZATION] is requesting designs for the next model used for home builds
- [NONPROFIT ORGANIZATION] will select the top design submitted
- Submissions are to be accompanied with a 3-minute presentation about the home
- Submissions are due on [DUE DATE]

Additional responses will vary

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What do we NEED to know about the project?

Content

- What is a technical drawing and how do you create one?
- How do you determine measurements for a technical drawing?
- What units do you use?
- What is the difference between room size and room capacity?
- How do you calculate room size?
- How do you calculate room capacity?

Product

- What is [NONPROFIT ORGANIZATION]?
- What is the criteria for selecting the top home design?
- What type of presentation can you prepare?

Additional responses will vary

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Additional Information

This PBL alternates content and design time so that students are consistently revising their products. This document is a framework for teachers to use. Teachers may manipulate it to fit the needs of their students and classroom. This is an example of how a teacher might organize this PBL to meet those needs.

Content Workshop #1 - Calculating area comprised of smaller individual shapes

Design Time #1 (Individual) - Sketch technical drawing of a home and calculate area of individual rooms and total home area using area formulas

Content Workshop #2 - Written equations representing area problems

Design Time #2 (Individual) - Revise technical drawing based on imposed maximum and minimum square footage constraints; write equations that determine area of house should more constraints occur

Content Workshop #3 - Written equations representing volume problems

Design Time #3 (Pair) - Select one design; write equations for volume of a basement (should a community require a basement)

Content Workshop #4 - Solutions to problems related to area and volume

Design Time #4 (Pair) - Calculate square footage of each room using the formula and the new maximum and minimum square footage constraints; design a backyard shed and calculate total volume

Content Workshop #5 - Unit conversion

Design Time #5 (Group) - Finish deliverables; convert equations such that both metric and customary values are displayed for international use

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Implementation Guide

Websites

Ensuring Mathematical Success for All:

<http://www.nctm.org/PtA/>

Area of Plane Shapes:

<http://www.mathsisfun.com/area.html>

Volume of Right Rectangular Prism:

<https://learnzillion.com/lessonsets/221-find-the-volume-of-a-right-rectangular-prism-with-fractional-edge-lengths-1>

Technical Drawing:

http://en.wikipedia.org/wiki/Technical_drawing

Design Process:

<http://www.sciencebuddies.org/engineering-design-process/engineering-design-process-steps.shtml>

Text Resources:

Consider having examples of technical drawings on hand for students to view or as a resource for measurement and scale.

Teaching Strategies/Considerations

Consider the guiding questions for the project when selecting content workshops. A combination of research and hands-on activities should be included.

Have students develop an understanding of measurement before designing their product(s).

Consider creating an initial assignment wherein students complete a technical drawing of their own home.

Consider creating new challenges to the design process throughout the project (e.g. increasing the number of bedrooms, adding a garage).

Consider having students use math notebooks or journals to meet the project expectations of recording their narrative process, design process, and design revisions. Have them record notes from content workshops.

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Assessment/Presentation

Final Group Product

- Home design submission that meets requirements
- Maximum 3-minute presentation about the home design and why it should be selected as the top design

Rubric

- Students will use the entry document as a real world rubric to meet expectations of the project.

Individual

- Individual assignments as they pertain to each content workshop
- Journal entries documenting what the individual has contributed to the home design submission
- Record of design process and revisions made over the course of design, assessed throughout the project
- Summative assessment

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