Integrated Project-based Learning: Combining PTE Standards and Academic Standards

Use this template for planning and sharing ideas for projects. This template is based on the *6 A's*:

Authenticity Academic Rigor* Applied Learning* Active Exploration* Adult Connections* Assessment*

Project

Title of Project	**The House that Math built!**
Project Developed by	Sally Toone and Bill Perry
E-mail Address	sally.toone@goodingschools.org
School	**Gooding High School**
Pathway / Small Learning Community/Academy	**Cabinetry/Millwork Academy**
Course Title(s)	**Applied Math/Geometry and Intro to Cabinetry/Millwork**
Time Frame	**2 days (2/3-60 minute classes)**

Authenticity

Briefly describe your project. Include the key question and provide an overview of what students do and learn. Tell why the question is meaningful to the students and where one might see a similar question tackled by an adult in the workplace.

Key Question	
Overview	**Students will construct a model size house. Students will measure accurately. They will be able to calculate surface areas and volumes. They will also calculate construction costs.**

Vocabulary/Key Terms

List vocabulary words and key terms essential to student understanding.

Length—base—horizontal	**Roof pitch, floor area**
Width—height—vertical	**Measurement units:**
Surface area, Volume	
Proportional units	

Active Exploration * Applied Learning * Adult Connections

What classroom-based, community-based, and career-based activities does the project involve? Include a description of the active exploration, applied learning, and adult connections in the project (as needed).

Active Exploration *How does the project engage students in real investigations using a variety of methods, media and sources? What field-based work will students perform? How does student learning and service support active career exploration?* Students will examine real models of homes. Math will expain scaled units in architecture. They will have lessons on home construction and the building codes for bids. How knowledge is used in industry?

Applied Learning *How do students apply what they have learned and researched to a complex problem (e.g. designing a product, improving a system, creating an exhibit, organizing an event)?* Lecture on industry usage of this concept i.e. model designs. Application with their own proportions also will be explored along with industry standards.

Adult Connections *Who from the community, workplace, postsecondary and/or industry partnership works with students on the project?* Lecture from local industry and community in home design.

Classroom Activities	Community Activities	Career Activities
Day 1 **Connection between math and industry.** **Review vocabulary. Explain scaling** **Start construction of model. Explain actual building with model** **Day 2** **Finish model** **Day 3 and 4 ?** **Finish paper work.** **Option: Do bid for house.** **Assessment—See outline at end**	**Possible field trip to architecture firm** **Building site field trip**	

Academic/PTE Rigor

Standards *Use the space below to list the state content standards and PTE industry standards addressed by the project. (A list of the content standards is available at http://www.sde.idaho.gov/ContentStandards/default.asp. This page, which includes selected high school level standards, is designed to let you easily create a list of standards you are addressing. You may then copy and paste the list into this template.)*

Academic/PTE Rigor

Math Content Standards

Goal 1.1: Understand and use numbers; Use positive and negative numbers, absolute value, fractions, decimals, percentages, and scientific notation, including application in real-world situations.

Goal 2.2: Apply the concepts of rates, ratios, and proportions; Use rates, ratios, proportions, map scales, and scale factors (one- and two-dimensional) in problem-solving situations.

Goal 2.4: Apply appropriate techniques and tools to determine measurements; Determine and use appropriate units.

Goal 3.1: Use algebraic symbolism as a tool to represent mathematical relationships; Represent mathematical relationships using variables, expressions, linear equations and inequalities.

Goal 4.1: Apply concepts of size, shape, and spatial relationships; Recognize and apply congruency and similarity of two-dimensional figures.

PTE Content Standard
Apply appropriate Basic Math Skills
Students will be able to: Solve basic math problems related to carpentry and/or cabinetmaking with and without a calculator; include basic geometry and algebra skills; solve problems, using board, linear, foot, square-foot, and cubic-foot measurements.; Measure horizontal and vertical surfaces, using millimeters, centimeters feet and inches; Identify fractions, decimals, and percentages.

Demonstrate Problem-Solving Skills

Students will be able to: Organize and plan multiple tasks, utilizing various resources such as time, personal, and materials; Analyze problems, identify the causes, and devise plans of action; Identify obstacles, generate alternatives, and choose the best alternatives.

School to Career Competencies *Please check (x) the competencies addressed by the project*

[X] Communicate and understand ideas and information
[X] Collect, analyze and organize information
[X] Identify and solve problems
[X] Use technology
[X] Initiate and complete entire activities
[ ] Act professionally
[X] Interact with others
[ ] Understand all aspects of an industry
[ ] Take responsibility for career and life choices

Student Goal(s) Once the project begins, ask students to generate one or two personal goals.

Assessment

How do you and the students know the project is a success? What are your criteria for measuring students' achievement of the disciplinary knowledge and applied learning goals of the project? What evidence do they use to demonstrate their progress? What deliverables do they need to complete prior to the final exhibition? How will students self-assess?

Reflection questions will be used with initial activity. Measurements for real world objects will be assessed through math and measurements. Work needs to be shown. Math: proportion work – ratio division, ratios equality. Homework page needs to be complete. Scaling with graph paper and design for final. CAD program possibly.

Recommended Resources / Sample Products

Recommended Resources / Sample Products

Software or Materials Needed *(Examples*)	**CAD Program**
Teacher-Developed Materials *(Examples of materials that can be shared with other classes. Please attach samples.)*	**See attached material**
Student-Developed Materials *(Examples of products that can be shared with other classes. Please attach samples.)*	
Websites Used *(Examples*)	
Final Words (In a sentence or two, highlight your project's overall value.)	**The project allows kids to use basic academic knowledge to apply it to product production in industry.**
Teacher Tips/Extensions (Use the first person to share a useful idea that helps with implementation and ensures success. Make it chatty, informal.)	
Extensions *(List any ideas for students who may want to go deeper into the learning standards.)*	**Actually build a model house of wood. Doll House and furnishings**

Timeline

What sequence of teaching and learning experiences will equip students to develop and demonstrate the PTE standards and the Academic standards?

Day 1:

- Project will be explained as well as a powerpoint. Students will be given directions and start. This includes a written answer section.
- House construction will be generally explained
- Start construction

Day 2

- Review yesterday
- Have students finish houses.

Timeline

Day 3

- Review math needed for worksheets
- Reflection with class chart—share.
- Assessment--Second survey—student discussion. Assessment page.

(Adapted from the Boston Public Schools Signature Projects.)

OUTLINE ON NEXT PAGE

“The House That Math Built”

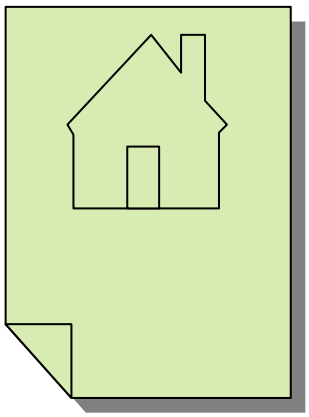
Instructional plan:
Objective: An integrated project for math and construction in the classroom. Students will build an attractive scale model home and calculate construction needs and costs using limited materials.

Theme: Using geometry, computational, measurement and problem solving math standards to give students practice in applying math to solve design needs.

Concepts:
- Use ideas of construction to create an attractive model.
- Apply math to solve real world problems; Pythagorean formula, measurements, area and volume formulas, scale, ratios.
- Engage in effective teamwork.
- Integrate professional-technical concepts with academics.

Tasks:
- Teams conceptualize design
- Review construction needs and designs
- Draw rough draft with measurements
- Construct scale model
- Review math formulas needed
- Compile materials list and calculate cost of construction for the house

Resources:
- Students: In groups of two or three
- Knowledge: Carpentry standards and math standards with calculation
- Tools: Architect scales, scissors, pencil, pen
- Materials: Card stock or poster board and clear tape
- Energy: Human
- Time: About 5 hours

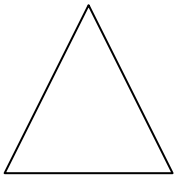


"The House That Math Built"

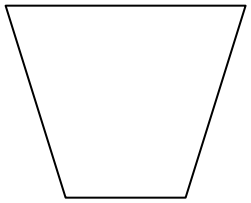
Formula Review:

Area = Used on all 2-dimensional (flat) surfaces. It is defined as the space inside a flat shape measured in square units.

Rectangular: Length * Width (basic area formula)

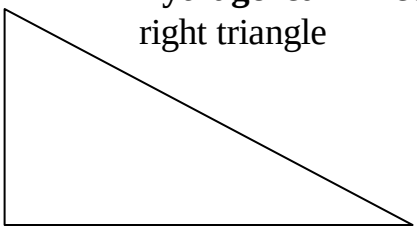


Triangular: ½ (Length * Width)



Trapezoid: Defined as a 4 sided shape with one set of parallel sides.
Formula : ½ (base 1 + base 2) * height

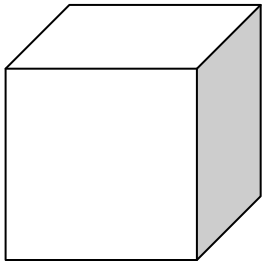
Pythagorean Theorem = Used to find the distance of the slant (Hypotenuse) on a right triangle



$$A^2 + B^2 = C^2$$

Volume = Used on all 3-dimensional figures. It is defined as the space inside a 3 – D shape measured in cubic units. All units must be of the same measurement. You will use this for the concrete measurement.

Box (Prism) : Length * Width * Depth (Thickness)



Sales Tax: This is a percent problem. Set it up as a ratio compared to a 100

Find 6% of $ 53.00 $\frac{6}{100} = \frac{?}{53.00}$

"The House That Math Built"

Material Units:

1. Concrete is sold in cubic yards, and you must round up to the nearest ½ yard. One yard of concrete equals 27 cubic feet or 46656 cubic inches.

2. Plywood is sold in 4' X 8' sheets in many thicknesses. Each sheet equals 32 square feet of 4608 square inches. On plywood you must round up to the next full sheet.

3. Drywall or sheet rock for our purposes comes in sheets that are 4' X 12' which equals 48 square feet or 6912 square inches. On drywall you must round up to the next full sheet.

4. Roof shingles are sold in squares which equals 100 square feet, round up to the next square.

Materials list:
1. 5/8 plywood is $18.90 per sheet
2. ½ inch thick drywall is $8.90 per 4' X 12' sheet
3. 3000 psi concrete is $59.00 per cubic yard
4. Roof shingles are $34.00 per square

Labor prices:
1. $11.90 per sheet to install plywood
2. $0.75 per square foot to pour and finish concrete
3. $15.90 per sheet to hang and finish sheet rock
4. $32.50 per square to install roof shingles

Sales Tax:
1. Sales tax will be charged at a rate of 6% of the total price of labor and materials.

“The House That Math Built”

1. How many square feet are in the floor of this house?

2. How many cubic yards of concrete will be needed to pour a floor 4 inches thick?

3. How much will the concrete job cost, poured and finished? (Add tax)

4. How many sheets of plywood will be needed for the walls?

5. How much will the labor and materials be to install the plywood on the walls? (Add tax)

6. How many sheets of plywood will be needed to cover the roof?

7. How much will the labor and materials be to install the plywood of the roof? (Add tax)

8. How many squares of roof shingles will be needed for this job?

9. How much will the labor and materials be to install the shingles on the roof? (Add tax)

10. How many sheets of drywall will be needed to cover the inside of the walls and a flat ceiling: (Hint, the same size as the floor is the ceiling)

11. How much will the labor and materials be to install and finish the drywall on

this job? (Add tax)

“The House That Math Built”

Grades
Model

Directions followed and done correctly		**40**
Neatness		**10**
Paper work done		
Answer for each question	**3 pt each**	**33**
shown work	**1 pt each**	**11**
On time		**06**
	Total	**100**

“The House That Math Built” Quiz