

Sugar Cube Dog House Math

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Discipline / Subject: Math/STEM

Topic: Sugar Cube Dog House Construction using multiplication and arrays

Grade Level: 2-8

Resources / References / Materials Teacher Needs:

- Boxes of sugar cubes for students - (amount depends on number of students)
- Containers of vanilla icing for students to use as “glue”
- Plastic utensils for spreading the icing
- Cardboard boxes - (box tops from reams of copy paper are ideal)
- <https://iditarod.com/edu/doghouse-design-with-musher-matt-failor/>
 - Read this for background information - Matthew Failor talks about the design of his dog houses starting below the video on the post
- <https://iditarod.com/zuma/hands-on-learning-at-michigan-symposium/>
 - Look at this for a blueprint/example on how the design is used

Lesson Summary:

- Students will construct doghouses based on pictures and discussions while using area and perimeter to plan and build

Standards Addressed: (Local, State, or National)

Ohio's Learning Standards: Math - **Grade 3**

- Measurement and Data
- 3.MD.5 Recognize area as an attribute of plane figures and understand concepts of area measurement.
 - a. A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area.
 - b. A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.
- 3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).
- 3.MD.7 Relate area to the operations of multiplication and addition.
 - a. Find the area of a rectangle with whole number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.

- b. Multiply side lengths to find areas of rectangles with whole number side lengths in the context of solving real-world and mathematical problems, and represent whole number products as rectangular areas in mathematical reasoning.
- c. Use tiling to show in a concrete case that the area of a rectangle with whole number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$ (represent the distributive property with visual models including an area model).
- d. Recognize area as additive. Find the area of figures composed of rectangles by decomposing into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real-world problems
- 3.MD.8 Solve real -world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

Ohio's Learning Standards: Math - Grade 4

Measurement and Data

- 4.MD.3 Develop efficient strategies to determine the area and perimeter of rectangles in real-world situations and mathematical problems. For example, given the total area and one side length of a rectangle, solve for the unknown factor, and given two adjacent side lengths of a rectangle, find the perimeter

Learning objectives:

1. Students will use perimeter and area to plan out and construct a dog house using sugar cubes.
2. They will have to use multiplication and division methods for planning purposes.

Assessment:

- Taken from the planning pages attached and math skills/work shown used to determine area and perimeter.

Procedural Activities

1. Review the concepts of area and perimeter and relate to real-world applications (architects, construction workers, project managers etc...)
- a. Explain that this is what the class will be doing
2. Show the following website
3. Watch the embedded video and read together the information about the dog houses in the couple paragraphs just below the video:
<https://iditarod.com/edu/doghouse-design-with-musher-matt-failor/>
4. Begin by introducing the activity and review the learning objectives
 - a. Each team will get 1 box to keep all of their supplies in
 - b. Each team receives:
 - i. 1 box
 - ii. ½ box of sugar cubes - this can change depending on your expectations

- iii. 1 container of vanilla frosting
 - iv. 1 plastic utensil/group member
 - v. Planning/work pages attached
- c. Show examples of sugar cubes and demonstrate how to “glue” the pieces together
 - d. May need to emphasize that “less is more” for the frosting
 - e. Possibly have a discussion about how to construct the walls (laying out the border (perimeter) and building up vs. building a wall laying flat and then combining them together towards the end
 - f. I always have the class construct ONLY the 4 walls - no floor or roof - but this could be done as a challenge activity
****walls should not be laid flat to dry as they can “glue” to the cardboard bottom****
5. Break the students into groups for the activity (no more than 4 is recommended)
 6. Explain that they need to have the math worked out (and possibly checked over by the teacher) first before construction
 7. Refer to this link for more information and a blueprint/outline for a real dog house <https://iditarod.com/zuma/hands-on-learning-at-michigan-symposium/>
 8. I always emphasize that this is a GROUP project and everyone needs to participate
 9. Groups then follow their blueprints to create their dog houses together
 10. Extension activity possibility: have the groups account for the opening for the dogs to get in and out of
 11. Extension activity could include measurements of each of their dog houses (with a ruler) to determine number of square units
 - a. These could then be used to measure and cut out cardboard pieces of the same size to “glue” (with frosting) the cardboard pieces onto the house to make it look more authentic
 12. Students then share/present their completed dog houses with the class

Materials Students Need:

- Pictures of dog houses displayed on a screen or in front of them to refer back to when building
- Pencils
- Rulers (possibly)
- Group Outline Paper (attached)

Technology Utilized to Enhance Learning:

- Available math apps to help students with larger multiplication numbers (for struggling learners) or a calculator
- Internet access to look at more examples of dog houses used (possible extension)

Other Information

- This lesson is done over a period of at least 2 days (after the construction of the walls, they need to harden overnight)

Modifications for special learners/ Enrichment Opportunities

- Enrichment activities could include measurements of each of their dog houses to determine number of square units
 - These could then be used to measure and cut out cardboard pieces of the same size to “glue” (with frosting) the cardboard pieces onto the house to make it look more authentic
- Modifications for special learners could be working with a partner to plan the structure and determine the area/perimeter - while they construct independently

Notes:

SCROLL TO THE NEXT PAGE FOR THE PLANNING SHEET!

Drawings & Equations