LESSON MAKER PRO

Design the Space

Use border limits to plan usable area.

HIGH SCHOOL · GDA.GM.K.38

GDA.GM.K.38 "Use the mathematical modeling cycle involving geometric methods to solve design problems."

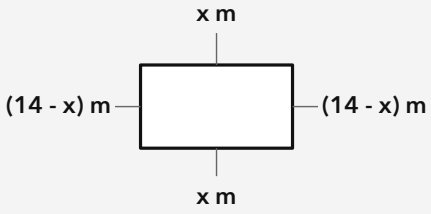
NAME _____ DATE _____

MODEL, THEN CHECK

For a rectangle, half its perimeter equals the sum of its length and width. With a fixed perimeter, a square has the greatest area. Check any size limits before choosing a design.

WORKED EXAMPLE

A rectangular mural has 28 m of border. What dimensions give it the greatest area?



1. The sides sum to 28/2 = 14 m.
2. Model the area: A = x(14 - x).
3. The product is greatest when both sides are 7 m.

Answer: 7 m by 7 m; maximum area 49 m^2

PRACTICE 4 problems

1 A rectangular poster has 20 in. of edge tape. Find the dimensions and greatest possible area.

ANSWER _____

2 A display has 36 m of edging. One side must be 6 m. Find the other side and the area.

ANSWER _____

3 A banner has 24 ft of trim. A designer proposes 4 ft by 8 ft. How much area would a maximum-area design gain?

ANSWER _____

4 A rectangle has a 32 cm border. Its width must be a whole number of centimeters no greater than 5 cm. Find the dimensions and greatest area.

ANSWER _____

APPLY IT Show your work

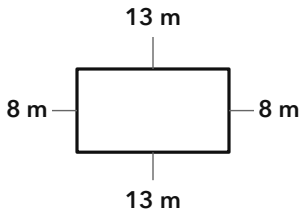
1 A club has 40 ft of railing and a 12 ft by 12 ft site for its booth. Which plan has more floor area and fits both limits?

BOOTH PLANS

Plan	Length	Width
A	11 ft	9 ft
B	15 ft	5 ft

ANSWER _____

2 A gaming club needs a floor mat with 2 m of clearance along every wall. What is the greatest area the mat can cover?



ANSWER _____

CHALLENGE One step up

A festival has 48 m of fence for a rectangular zone. A 2 m walkway runs inside every edge. The outer width must be a whole number from 5 m to 9 m. Which outer dimensions give the greatest area inside the walkway? Explain.

WORK SPACE AND ANSWER

ANSWER KEY

Design the Space

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A rectangular poster has 20 in. of edge tape. Find the dimensions and greatest possible area.	**5 in. by 5 in.; 25 in^2**
2	A display has 36 m of edging. One side must be 6 m. Find the other side and the area.	**12 m; 72 m^2**
3	A banner has 24 ft of trim. A designer proposes 4 ft by 8 ft. How much area would a maximum-area design gain?	**4 ft^2**
4	A rectangle has a 32 cm border. Its width must be a whole number of centimeters no greater than 5 cm. Find the dimensions and greatest area.	**5 cm by 11 cm; 55 cm^2**

PART 2 · APPLY IT

1. **Plan A: 99 ft^2. It uses 40 ft of railing and fits the site.** Both plans use 40 ft of railing. Plan A has 99 ft^2 and fits; Plan B has 75 ft^2 and is too long.
2. **36 m^2** Clearance on both ends of each dimension leaves 9 m by 4 m for the mat. Its area is 36 m^2.

CHALLENGE

9 m by 15 m; usable area 55 m^2. If the outer width is x, the usable area is (x - 4)(20 - x). This increases from x = 5 to x = 9, so x = 9 is best.

Accept either order for a rectangle's dimensions. For the challenge, accept a comparison of all five allowed widths instead of the area model.