LESSON MAKER PRO

Design Dimensions Lab

Use area, perimeter, and ratios to make designs fit.

HIGH SCHOOL · HSG-MG.A.3

CCSS.Math.Content.HSG-MG.A.3 "Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). *"

NAME _____ DATE _____

TURN LIMITS INTO EQUATIONS

Translate each design limit into an equation before solving. If a rectangle has side ratio a:b, write its sides as ax and bx, then use area or perimeter to find x. For a fixed perimeter, a square gives the greatest possible area among rectangles.

WORKED EXAMPLE

A rectangular mural has a width-to-length ratio of 7:11 and an area of 1,232 square feet. Find its dimensions.

1. Let the width be 7x and the length be 11x.
2. Area: $(7x)(11x) = 1{,}232$, so $77x^2 = 1{,}232$.
3. $x^2 = 16$, so $x = 4$ because a length is positive.
4. Width = 28 feet and length = 44 feet.

Answer: 28 feet by 44 feet

PRACTICE 6 problems

1 A rectangular garden bed has a width-to-length ratio of 3:8 and an area of 864 square feet. Find its dimensions.

ANSWER _____

2 A rectangular display has a width-to-length ratio of 9:13 and an area of 1,053 square inches. Find its dimensions.

ANSWER _____

3 A rectangular practice court has a width-to-length ratio of 3:9 and a perimeter of 72 meters. Find its dimensions.

ANSWER _____

4 A rectangular community garden is 15 feet longer than it is wide and has an area of 756 square feet. Find its dimensions.

ANSWER _____

5 A rectangular dog run must have a perimeter of 68 meters. What dimensions give the greatest possible area, and what is that area?

ANSWER _____

6 A rectangular banner has a width-to-length ratio of 1:2 and an area of 288 square inches. Find its perimeter.

ANSWER _____

APPLY IT Show your work

1 The theater club is making a rectangular photo-booth backdrop. Its width-to-length ratio must be 3:5, and it must use exactly 128 inches of trim around all four sides. Find the backdrop's dimensions and area.

WORK SPACE

ANSWER _____

2 A student group orders a rectangular custom sign for a skate event. The sign's length is 3 times its width, and its area is 432 square inches. Printing costs $2 per square inch, and border material costs $1 per inch. Find the dimensions and total cost.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Two rectangular banners each have an area of 216 square inches. Banner A has a width-to-length ratio of 2:3. Banner B has a width-to-length ratio of 3:8. Border material costs $3 per inch. Which banner costs less to border, and how much less does it cost? Show enough work to justify your choice.

WORK SPACE AND ANSWER

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A rectangular garden bed has a width-to-length ratio of 3:8 and an area of 864 square feet. Find its dimensions.	**18 feet by 48 feet**
2	A rectangular display has a width-to-length ratio of 9:13 and an area of 1,053 square inches. Find its dimensions.	**27 inches by 39 inches**
3	A rectangular practice court has a width-to-length ratio of 3:9 and a perimeter of 72 meters. Find its dimensions.	**9 meters by 27 meters**
4	A rectangular community garden is 15 feet longer than it is wide and has an area of 756 square feet. Find its dimensions.	**21 feet by 36 feet**
5	A rectangular dog run must have a perimeter of 68 meters. What dimensions give the greatest possible area, and what is that area?	**17 meters by 17 meters; 289 square meters**
6	A rectangular banner has a width-to-length ratio of 1:2 and an area of 288 square inches. Find its perimeter.	**72 inches**

PART 2 · APPLY IT

1. **24 inches by 40 inches; 960 square inches** Let the dimensions be 3x and 5x. The perimeter equation $2(3x + 5x) = 128$ gives $x = 8$, so the area is $24 \times 40 = 960$ square inches.
2. **12 inches by 36 inches; $960** Let the width be x and the length be 3x, so $3x^2 = 432$ and $x = 12$. Printing costs $864, and the 96-inch border costs $96, for a total of $960.

CHALLENGE

Banner A costs less. Banner A is 12 inches by 18 inches, so its border costs 60 x $3 = $180. Banner B is 9 inches by 24 inches, so its border costs 66 x $3 = $198. Banner A costs $18 less.

Accept dimensions in either order when the problem does not name width and length separately. For the maximum-area item, accept a correct statement that a square has the greatest area for a fixed rectangular perimeter.