GHCI/MFM1P   Name: _____
Date: _____

Problem Solving with Optimizing Rectangles

1. A store owner uses 16 m of rope for a rectangular display. There is a wall on one side, so the rope is only used for the other 3 sides.

(a) What are the dimensions of the maximum area that can be enclosed?

(b) How are these dimensions related?

2. Cody has 20 m of fencing to build a rectangular pen for his dog. One side of the pen will be against his house. What dimensions give the maximum area for the pen?
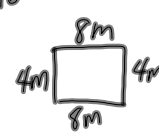
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#1 (16 m) of rope → 3 sides

$2w+w+w = 16$

$\dfrac{4w}{4} = \dfrac{16}{4}$

$w = 4$

(a) $A_{max} = ?$

The dimensions are 4 m by 8 m.

(b) The length is 2 times the width.

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3. Michael was building a rectangular patio with 36 square stones. To save money on edging, Michael decides to place the patio against the side of the house. Now, edging will be needed on only three sides of the patio.

(a) What should the dimensions be, in terms of square stones, so the patio uses the minimum length of edging? Justify your answer. (Hint: Show at least 3 possible dimensions to justify.)

36 stones (only edge 3 sides)
$1 \times 36 \Rightarrow 1+36+1 = 38$
$2 \times 18 \Rightarrow 2+18+2 = 22$
$3 \times 12 \Rightarrow 3+12+3 = 18$
$4 \times 9 \Rightarrow 4+9+4 = 17 \leftarrow$ shortest
$6 \times 6 \Rightarrow 6+6+6 = 18$

Dimensions are 4 stones by 9 stones

(b) Each stone has length 30 cm. What is the minimum length of edging?

$w = 4$ stones $= 4 \times 30 = 120$ cm
$\ell = 9$ stones $= 9 \times 30 = 270$ cm
Edging $= 2(120) + 270 = 510$ cm

The minimum edging length is 510 cm.

4. A patio is to be built on the side of a house using 24 congruent square stones. It will then be edged on 3 sides. Which arrangement requires the minimum edging? Justify your answer.

Possible dimensions: Area = 24 stones
$1 \times 24 \rightarrow 1+24+1 = 26$
$2 \times 12 \rightarrow 2+12+2 = 16$
$4 \times 6 \rightarrow 4+6+4 = 14$ edging length

Either 3 stones by 8 stones or 4 stones by 6 stones

Answers: 1. (a) 4 m by 8 m, (b) length is twice the width; 2. 10 m by 5 m; 3. (a) 4 stones by 9 stones, (b) 510 cm; 4. 3 stones by 8 stones or 4 stones by 6 stones

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