CHAPTER 9: Optimizing Measurements
9.2 Perimeter and Area Relationships of a Rectangle
Perimeter and Area Relationships of a Rectangle: Optimization

Optimizing the area of a rectangle means finding the dimensions of the rectangle with maximum area for a given perimeter.
The dimensions of a rectangle with optimal area depend on the number of sides to be fenced.

Example:

a) Charlie has a plank 8 m long. He plans to cut it into four pieces to make a rectangular sandbox for his sister Sally. Show that he can maximize the area of the sandbox by using a square with a side length of 2 m.

b) Jaywardene is planning a rectangular flower bed behind his house, using the side of the house as one edge. The other edges will have a plastic retainer. If he has 10 m of retainer available, show that the maximum area for the garden is 12.5 m^2.

Solution:

a) Use pencil and paper, a graphing calculator, a spreadsheet, or other aid to make a table of possible lengths and widths that result in a perimeter of 8 m. Calculate the area for each, as shown. The maximum area of 4 m^2 occurs when Charlie uses a square with a side length of 2 m.

Length (m)	Width (m)	Perimeter (m)	Area (m^2)
3.5	0.5	8	1.75
3.0	1.0	8	3.00
2.5	1.5	8	3.75
2.0	2.0	8	4.00
1.5	2.5	8	3.75
1.0	3.0	8	3.00
0.5	3.5	8	1.75

b) The plan of the flower bed is shown. Jaywardene must edge three sides, consisting of one length and two widths. Use pencil and paper, a graphing calculator, a spreadsheet, or other aid to make a table of possible lengths and widths that result in a perimeter of 10 m. Calculate the area for each, as shown. The maximum area of 12.5 m^2 occurs when Jaywardene uses a rectangle with a length of 5 m and a width of 2.5 m.

Wall of House

Flower Bed   Width
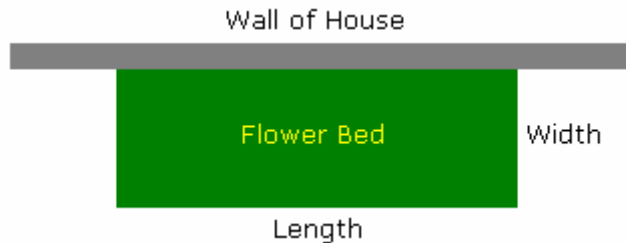
Length

Length (m)	Width (m)	Perimeter (m)	Area (m^2)
8.0	1.0	10	8.00
7.0	1.5	10	10.50
6.0	2.0	10	12.00
5.0	2.5	10	12.50
4.0	3.0	10	12.00
3.0	3.5	10	10.50

Practice:

1. a) The city is planning to build a rectangular wading pool in the park. The budget allows for 20 m of concrete wall 80 cm high. Find the dimensions of the pool that maximize the wading area, and the maximum area.

b) Renaldo has built a hangar for his airplane, and he plans to wall off one corner for a rectangular workshop. He has 14 m of wall left over from the building of the hangar. Assuming that he will use two corner walls of the hangar as two of the walls of his workshop, find the dimensions that maximize the floor area of the workshop, and the maximum area.

Hangar Wall

Hangar Wall

Inside Wall

Workshop

Inside Wall
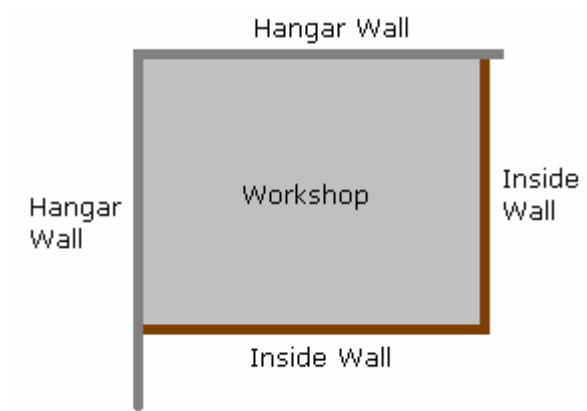
Answers:

1. a) 5 m by 5 m, 25 m^2 b) 7 m by 7 m, 49 m^2