

Optimization is the process of finding values that make a given quantity the greatest (or least) possible given certain conditions.

Maximum Area for a Fixed Perimeter

Problem 1: Farmer Brown wants to build a rectangular pen for his ostriches. He has **24 metres** of fencing available; therefore, the perimeter should be 24m. Determine the **maximum** (largest) area, he can enclose.

Rectangle	Width (m)	Length (m)	Perimeter (m)	Area (m ²)
1			24	
2			24	
3			24	
4			24	
5			24	
6			24	
7			24	
8			24	
9			24	
10			24	
11			24	

- Which rectangular area is the largest? _____
 What are the dimensions of this rectangle? _____
- Which rectangular area is the smallest? _____
 What are the dimensions of this rectangle? _____
- Which rectangular pen is the optimal one for farmer Brown? Why?

CONCLUSION:
 A _____ will always produce the **largest** area for a given perimeter.

Try these: Find the dimensions (integer values) of the largest rectangular area that can be made given the following perimeters:

- a. 48m b. 100m c. 38m d. 47m

Minimum Perimeter for a Fixed Area

Problem 2: Mrs. Jones would like to build a garden shed. The shed must have an area of 36 m^2 to provide the necessary space. Mrs. Jones wants to keep her cost of materials as low as possible.

Rectangle	Width (m)	Length (m)	Perimeter (m)	Area (m^2)
1				36
2				36
3				36
4				36
5				36
6				36
7				36
8				36
9				36

1. What are the dimensions of the rectangle with the largest perimeter? _____
What is the perimeter of that rectangle? _____
2. What are the dimensions of the rectangle with the smallest perimeter? _____
What is the perimeter of that rectangle? _____
3. Which one should Mrs. Jones choose? Why? _____

CONCLUSION:

A _____ will always produce the smallest perimeter for a given area.

Try these: Find the dimensions (integer values) of the smallest rectangular area that can be made given the following areas:

a. 36m^2

b. 100m^2

c. 30m^2

d. 143m^2

3-SIDED FENCE

Problem 3: Jessica has 16 m of fencing to enclose a dog pen against the side of a house. She wants to maximize the area for her dog, while using only the 16 m of fencing,

Rectangle	Width (m)	Length (m)	Perimeter (m)	Area (m ²)
1			16	
2			16	
3			16	
4			16	
5			16	
6			16	
7			16	

What are the dimensions of the rectangle with the maximum or optimal area? _____

The maximum area is _____ The length is ___ times the width.

How can you predict the maximum area if you know the perimeter of an area enclosed on 3 sides?

Predict the dimensions of a rectangle with maximum area and a perimeter of 60 m, enclosed on only 3 sides. State the dimensions.

Questions

1. An inbox tray has 3 walls and an open side on one of the longer sides. Determine the maximum area of the tray if all three walls total to a length of 812 mm.

2. The perimeter of a rectangular piece of cardboard is 46 centimetres. Determine the dimensions that maximize the area.

3. The maximum area of a fenced in pool deck is 1024 m^2 . Determine the length of fencing that is required.

4. Three sides of a look-out deck have a railing, while the fourth side is open. Determine the maximum area if there is 648 cm of railing.

5. The area of a rectangular box is $722\,500 \text{ mm}^2$. Determine the dimensions that minimize the perimeter.