

- A rectangular field is to be bounded by a fence on three sides and by a straight stream on the fourth side. Find the dimensions of the field with maximum area that can be enclosed with 1000 feet of fence.
- A sheet of cardboard 12 in. square is used to make an open box by cutting squares of equal size from the four corners and folding up the sides. What size squares should be cut to obtain a box with largest possible volume?

- A rectangle has its two lower corners on the x-axis and its two upper corners on the curve $y = 45 - x^2$. For all such rectangles, what are the dimensions of the one with the largest area?

- Find two numbers whose sum is 20 and whose product is maximum.

- A closed rectangular container with a square base is to have a volume of 2000 cm³. Find the dimensions of the box with the least surface area.

- Bruce is on the bank of a river that is 1 mi. wide. He wants to travel to the town of Casco on the opposite bank, but 1 mi. upstream. He intends to row on a straight line to some point on the opposite bank and then walk the remaining distance along the bank. To what point should he row in order to reach his destination in the least time if he can walk 5 mi/hr and row 3 mi/hr?

- A closed cylindrical can is to hold 2000 cm³ of liquid. How should you choose the height and radius to minimize the amount of material needed to manufacture the can?

- A piece of wire 20 cm. long is cut into two pieces; one piece is bent to form a circle and the other is bent to form a square. Where should the cut be made in order that the sum of the areas of the square and circle be a minimum?

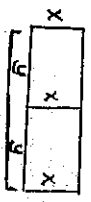
1. _____ 4. _____ 7. _____

2. _____ 5. _____ 8. _____

3. _____ 6. _____

Henry, who is in a rowboat 2 miles from the nearest point B on a straight shoreline, notices smoke blowing from his house, which is 6 miles down the shoreline from B. He figures he can row at 6 mph and run 10 mph. How should he proceed in order to get to his house in the least amount of time?

A farmer wishes to fence off two identical adjoining rectangular pens, each with 900 square feet of area, as shown in the figure below.



- What are the outside dimensions of the pens so that the least amount of fence is required?

- Suppose the outer boundary of the pens requires heavy fence that costs \$3 per foot, but that the middle partition requires fence costing only \$2 per foot. What dimensions will produce the least expensive fence?

- A piece of wire 16 inches long is cut into two pieces, one piece is bent to form a square and the other is bent to form a circle. Where should the cut be made in order that the sum of the areas of the square and the circle be a minimum?

- A container with square base, vertical sides, and open top is to be made from 1000 ft² of material. Find the dimensions of the container with the greatest volume.

- If a closed tin can of volume 16π cubic inches is to be in the form of a right-circular cylinder, find the height and radius if the least amount of material is to be used in its manufacture.

- A one-story building having a rectangular floor space of 13,200 square feet is to be constructed where a walkway 22 feet wide is required in the front and back and a walkway 15 feet wide is required on each side. Find the dimensions of the lot having the least area on which this building can be located.

- An open box is to be made from a 3-ft by 8-ft rectangular piece of sheet metal by cutting out squares of equal size from the four corners and bending up the sides. Find the maximum volume that the box can have.

- A cone shaped paper drinking cup is to hold 10 cm³ of water. Find the height and radius of the cup that will require the least amount of paper. ($V = \frac{1}{3}\pi r^2 h$, $SA = \pi r\sqrt{r^2 + h^2} + \pi r^2$)

ANSWERS

1. _____ 3. _____ 6. _____

2a. _____ 4. _____ 7. _____

2b. _____ 5. _____ 8. _____