

## M119 Supplement Optimization 3.5

Use Calculus to set up and optimize the following problems.

1. *Maximum Volume*

A manufacturer wants to design an open box that has a square base and a surface area of 108 square inches. What dimensions will produce a box with maximum volume? What is the maximum volume?

2. *Maximum Income*

A car rental agency rents 200 cars per day at a rate of \$30 per day. For each \$1 increase in rate, 5 fewer cars are rented. At what rate should the cars be rented to produce the maximum income? What is the maximum income?

3. *Minimum Perimeter*

A dairy farmer plans to enclose a rectangular pasture adjacent to a river. To provide enough grass for the herd, the pasture must contain 180,000 square meters. No fencing is required along the river. What dimensions use the least amount of fencing? What is the least amount of fencing needed?

4. *Maximum Volume*

A candy box is to be made out of a piece of cardboard that measures 8 by 12 inches. Squares of equal size will be cut out of each corner, and then the ends and sides will be folded up to form a rectangular box. What size square should be cut from each corner to obtain a maximum volume? What is the maximum volume?

5. *Area*

A rancher has 200 feet of fencing to enclose two adjacent rectangular corrals. What dimensions should be used so that the enclosed area will be maximum? What is the maximum area?

6. *Minimum Cost*

A manufacturer of storage bins plans to produce some open-top rectangular boxes with square bases. The volume of each box is to be 125 cubic feet. Material for the base costs \$6 per square foot, and material for the sides cost \$3 per square foot. Determine the dimensions of the box that will minimize the cost of materials. What is the minimum possible cost for the box?

7. *Surface Area*

A net enclosure for golf practice is open at one end. The end is a square and the ground is not enclosed. The volume of the enclosure is  $83\frac{1}{3}$  cubic meters. Find the dimensions that require the least amount of netting. What is the least amount of netting needed?

### **SOLUTIONS**

1. 6" X 6" X 3", 108 cu. In.
2. \$35 per day, \$6125
3. 300 m. by 600 m., 1200 m.
4. 1.57 in by 4.86 in. by 8.86 in, 67.60 cu. In
5. 50 ft by  $33\frac{1}{3}$  ft, "cross pieces";  $1666\frac{2}{3}$  sq ft.
6. 5 by 5 by 5, \$450
7. 5 by 5 by  $3\frac{1}{3}$ , 75 sq. m.