Section 3.7: mathematical modeling – building functions

1) A campground owner has 800 meters of fencing. He wants to enclose a rectangular field. Let W represent the width of the field. Follow these steps to find the dimensions of the field that yields the largest area.

a) Write an equation for the length of the field

b) Write an equation for the area of the field.

c) Find the value of w leading to the maximum area

d) Find the value of L leading to the maximum area

e) Find the maximum area.

2) A campground owner has 1000 meters of fencing. He wants to enclose a rectangular field bordering a river, with no fencing needed along the river. Let W represent the width of the field. Follow these steps to find the dimensions of the field that yields the largest area.

a) Write an equation for the length of the field

b) Write an equation for the area of the field.

c) Find the value of w leading to the maximum area

d) Find the value of L leading to the maximum area

e) Find the maximum area.

3) A campground owner has 1400 meters of fencing. He wants to enclose a rectangular field bordering a river, with no fencing needed along the river, and let W represent the width of the field. Follow these steps to find the dimensions of the field that yields the largest area.

a) Write an equation for the length of the field

b) Write an equation for the area of the field.

c) Find the value of w leading to the maximum area

d) Find the value of L leading to the maximum area

e) Find the maximum area.

4) A campground owner has 1000 meters of fencing. He wants to enclose a rectangular field bordering a river, with no fencing needed along the river, and let W represent the width of the field.

a) Write an equation for the length of the field

b) Write an equation for the area of the field.

c) Find the value of w leading to the maximum area

d) Find the value of L leading to the maximum area

e) Find the maximum area.

5) A fence must be built to enclose a rectangular area of 20,000 square feet. Fencing material costs $2.50 per foot for the two sides facing north and south (call these sides the length, and $3.20 per foot for the other two sides (call these sides the width). Follow these steps to find the cost of the least expensive fence.

a) Write an equation for the length of the field.

b) Write an equation for the cost of the field.

c) Find the value of W leading to the minimum cost

d) Find the value of L leading to the minimum cost

e) Find the minimum cost.

6) A fence must be built to enclose a rectangular area of 20,000 square feet. Fencing material costs $2.00 per foot for the two sides facing north and south (call these sides the length, and $4.00 per foot for the other two sides (call these sides the width). Follow these steps to find the cost of the least expensive fence.

a) Write an equation for the length of the field.

b) Write an equation for the cost of the field.

c) Find the value of W leading to the minimum cost

d) Find the value of L leading to the minimum cost

e) Find the minimum cost.

7) A fence must be built in a large field to enclose a rectangular area of 25,600 square meters. One side of the area is bounded by an existing fence; no fence is needed there. Material for the fence costs $3.00 per meter for the two ends, and $1.50 per meter for the side opposite the existing fence. Find the cost of the least expensive fence.

a) Write an equation for the length of the field.

b) Write an equation for the cost of the field.

c) Find the value of W leading to the minimum cost

d) Find the value of L leading to the minimum cost

e) Find the minimum cost.

8) A fence must be built in a large field to enclose a rectangular area of 10,000 square meters. One side of the area is bounded by an existing fence; no fence is needed there. Material for the fence costs $5.00 per meter for the two ends, and $2.00 per meter for the side opposite the existing fence. Find the cost of the least expensive fence.

a) Write an equation for the length of the field.

b) Write an equation for the cost of the field.

c) Find the value of W leading to the minimum cost (round to 2 decimals)

d) Find the value of L leading to the minimum cost (round to 2 decimals)

e) Find the minimum cost.

9) An open box with a square base is to be made from a square piece of cardboard 10 inches on a side by cutting out a square (x inches by x inches) from each corner and turning up the sides. (round to 2 decimals if needed)

a) Sketch a diagram that models the problem.
b) Write an equation for the volume of the box.
c) Graph the volume function using your graphing calculator and find the value of x that makes V the largest.

10) An open box with a square base is to be made from a square piece of cardboard 12 inches on a side by cutting out a square (x inches by x inches) from each corner and turning up the sides.

a) Sketch a diagram that models the problem.
b) Write an equation for the volume of the box.
c) Graph the volume function using your graphing calculator and find the value of x that makes V the largest.

11) An open box is to be made by cutting a square corner of a 20 inch by 20 inch piece of metal then folding up the sides. What size square should be cut from each corner to maximize volume? (round to 2 decimals if needed)

a) Sketch a diagram that models the problem.
b) Write an equation for the volume of the box.
c) Graph the volume function using your graphing calculator and find the value of x that makes V the largest. (round to 2 decimal places if needed)

12) An open box is to be made by cutting a square corner of a 30 inch by 30 inch piece of metal then folding up the sides. What size square should be cut from each corner to maximize volume?

a) Sketch a diagram that models the problem.
b) Write an equation for the volume of the box.
c) Graph the volume function using your graphing calculator and find the value of x that makes V the largest. (round to 2 decimal places if needed)