Calculus: Optimization Worksheet **Name: ______________________________**

1. A gardener wants to make a rectangular enclosure using a wall as one side and 120 m of fencing for the other three sides. Find the maximum area of the enclosure.

a. What is being maximized or minimized?

words: ____

equation: ____

b. What are the constraints? Do you need to draw a picture?

words: _____________________________________

equation: __________________________________

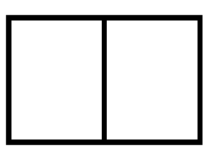
c. Solve the constraint equation for one variable:

d. Use the constraint equation to rewrite the max/min function in terms of one variable and simplify it.

e. Find the critical points. Determine the absolute max or min.

f. Read the problem again, have you answered it? Does your answer make sense in the problem?
Write a sentence to answer the question.

2. Suppose you had 102 m of fencing to make two side-by-side enclosures as shown. What is the maximum area that you could enclose?



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3. Four pens will be built side by side along a wall by using 150 feet of fencing. What dimensions will maximize the area of the pens.

4. Suppose you had to use exactly 200 m of fencing to make either one square enclosure or two separate square enclosures of any size you wished. What plan would give you the least area? What plan would give you the greatest area?

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

6. A box with an open top is to be constructed from a square piece of cardboard, 3 feet wide, by cutting out a square from each of the four corners and bending up the sides. Find the largest volume that such a box can have.

7. A box manufacturer desires to create a box with a surface area of 100 in^2. What is the maximum volume that can be formed by bending this material into a closed box with a square base, square top, and rectangular sides?

8. A tank with a rectangular base and rectangular sides is open at the top. It is to be constructed so that its width is 4 meters and its volume is 36 cubic meters. If building the tank costs \$10/m^2 for the base and \$5/m^2 for the sides, what is the cost of the least expensive tank, and what are its dimensions?

9. A regular soda pop can has a diameter of about 6.8 cm with a height of 12.5 cm. It holds 355 ml of soda pop. Find the dimensions of a can that has the same volume but uses the least amount of material to construct. Note: 1 cm^3 = 1 ml

10. A cylinder has a volume of 300 in^3. The top and bottom parts of the cylinder cost \$2 per in^2 and the sides of the cylinder cost \$6/in^2. What are the dimensions of the most economical cylinder and how much will it cost?

11. The combined perimeter of an equilateral triangle and a square is 10. Find the dimensions of the triangle and square that produce a maximum total area. The triangle and square are separate shapes.

12. The combined perimeter of a circle and a square is 16. Find the dimensions of the circle and square that produce a minimum total area. The circle and square are separate shapes.

13. Find the point on the graph of $y = x^2$ that is the smallest distance from the point (0, 6).