Calculus AP/Dual Worksheet Rev 2017 **Name: _____**

§3.7: Optimization **Date: _____ Period _____**

Show all work on a separate sheet of paper. Show all steps and equations. Draw a diagram if possible, label appropriately and justify response.

1) The product of 192 and the sum of the first plus three times the second is a minimum. What are the numbers?

2) The sum of the first and twice the second is 100 and the product is a maximum. What are the numbers?

3) Find the maximum area of rectangle where the length and width have a given perimeter of 100 meters.

4) Find the minimum perimeter of rectangle where the length and width have a given area of 64 meters.

5) Find the shortest distance from $f(x) = x^2$ to the point $\left(2, \frac{1}{2}\right)$.

6) Which points of the graph of $y = 4 - x^2$ are closest to the point of $(0, 2)$?

7) Find the points of the hyperbola $y^2 - x^2 = 4$ that are closest to the point $(2,0)$.

8) Find the dimensions of the largest rectangle that can be inscribed in a semicircle of radius of 3.

9) Gary the Gardener wants to make a rectangular enclosure using a wall as one side and 120 meters of fencing for the other three sides. Express the area in terms of x and find the value of x that offers the greatest area.

10) A rectangle has a perimeter of 80 cm. If its width is *x*, express the length and area in terms of *x*, and find the maximum area.

11) A man is going to use 600 yards of fencing to enclose and subdivide a rectangular filed into two plots with a fence parallel to a side. Of all the possible fields that can be fenced, what are the dimensions of the one of maximum area?

12) If 350 feet of fencing will be used to enclosed two adjacent rectangular pens. What dimensions should be used so that enclosed area will be a maximum? Then prove it is a maximum.

13) A rectangular page is to contain 30 square inches of print. The margins of each side are 1 inch. Find the dimensions of the page such that the least amount of paper is used. Then prove it is a minimum.

14) You are designing a poster to contain 50 square inches of printing with margins of 4 inches each at the top and bottom and 2 inches at each side. What overall dimensions will minimize the amount of paper used? Then prove it is a minimum.

15) Midas Muffler charges $28 to replace a muffler. At this rate, this company replaces 75,000 mufflers per week nationally. For each additional dollar that the company charges, it tends to lose 1,000 customers a week. For each dollar, the company subtracts from the $28, the company gains 1,000 per week. How much should Midas charge to change a muffler to maximize their revenue? What would that revenue be?

16) Real estate office handles 50 apartment units. When the rent is $540 per month, all units are occupied. However, on the average, for each $30 increase in rent, one unit becomes vacant. Each occupied unit requires an average of $36 per month for service and repairs. What rent should be charged to realize the most profit?

Answer Key:

1) $(24,8)$ 2) $(50,25)$ 3) $(25,25)$ 4) $(8\ meters, 8\ meters)$

5) $d = \frac{\sqrt{5}}{2}$ 6) $\left(\pm\sqrt{\frac{3}{2}}, \frac{5}{2}\right)$ 7) $\left(1, \sqrt{5}\right)$ 8) $\frac{3}{\sqrt{2}} \times \frac{6}{\sqrt{2}}$

9) x = 30 feet 10) $A = 400\ ft^2$ 11) $A = 100 \times 150\ yards$ 12) $A = (58.333\ ft., 43.75\ ft.)$

13) $\left(\pm\sqrt{30} + 2", \frac{30}{\sqrt{30}} + 2"\right)$ 14) $(18,9)$ 15) $51.50 16) Rent: $1050 per student