Name_____ Date_____ Per_____

Optimization Worksheet: AP Calculus. Calculator OK

Do all work on notebook paper. Round to three decimals. Show all steps leading to your calculator plug-in step. USE calculus.

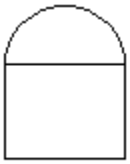
1. Mr. Wenzel has a big problem. He has a sphere of radius 3 feet ands he is trying to find the volume of a right circular cone with maximum volume that can be inscribed inside his sphere. Aside from any problems of actually getting the cone into the sphere, help Mr. Wenzel find the volume of the aforementioned right circular cone.

2. A rectangle has its vertices o the *x*-axis, the *y*-axis, the origin, and the graph of $y = 4 - x^2$. Find the maximum possible area for such a rectangle.

3. Find the point of the graph of the equation $y = x^2$ that is nearest to Mr. Kilford. Assume Mr. Kilford is standing at the point $(3, 0)$.

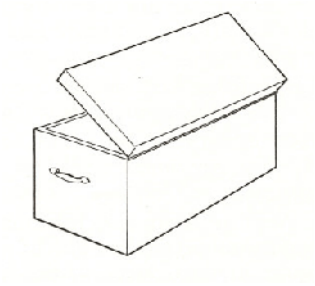
4. Farmer Tate's apple orchard now has 30 trees per acre, and the average yield is 400 apples per tree. For each additional tree that he plants per acre, the average yield per tree is reduced by approximately 10 apples. How many trees per acre will give Farmer Tate the largest crop of apples?

5. The City of NB has a great idea. A rectangular field is to be fenced off along the bank of the Guadalupe River and no fence is required along the river bank (thus allowing the raucous, tubing BC calculus class to loiter on the property and leave their mathematical trash). If the material for the fence costs \$4 per running foot for the two ends and \$6 per running foot for the side parallel to the river, find the dimensions of the field of largest possible area that can be enclosed with \$1800 worth of fencing.



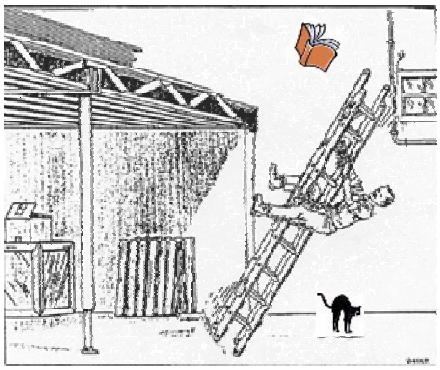
6. A Norman window has a lower section in the shape of a rectangle and an upper portion in the shape of a semicircle mounted on the upper side of this rectangle (see picture at right). If the window is to be surrounded by 10 feet of metal border (not including the part connecting the rectangle to the semi-circle), find the radius of the semicircular part if the total area of the window is to be a maximum.

7. Find the dimensions of the base of a rectangular box of greatest volume, hopefully large enough to contain the enthusiasm of Mr. Korpi's calculus students, that can be constructed from 200 square inches of cardboard if the base is to be three times as long as it is wide. The box has a top included (but incidentally, no extra cardboard for flaps).

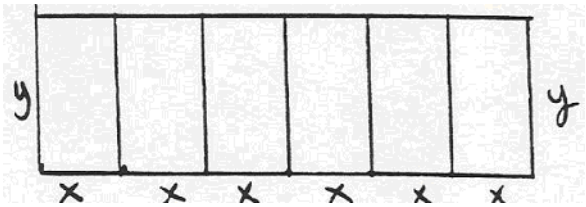


8. David Mis is the proud owner of the manufacturing plant of "Mister Mis's Misters, Inc." There, he manufactures misting cooling machines. The company has the capacity of producing 25 misters per week. Experience has shown that *n* misters per week can be sold at the price of *p* dollars each, where $p = 110 - 2n$, and the cost of producing *n* misters is $C = (600 + 10n + n^2)$ dollars. How many misters should be made each week to give Mister Mis the largest mister profit?

9. A ladder (with Korpi on the rungs) is to reach over a fence 8 feet high to a wall one foot behind the fence. This will allow Korpi access to a window where a dastardly student awaits to drop a calculus book on his head. What is the length of the shortest ladder that can be used? Assume a black cat will be beneath the ladder.



10. Jenna wants to build a motel for her pet ladybugs. She envisions a six-room motel to be built with the floor plan below. Each room is to have 350 square inches of floor space, bits of cracker crumbs, a whirlpool ladybug spa, a lamp with a burned-out bulb, and a picture of Hannah Montana on the wall. What dimensions should the rooms be in order to have the minimum total length of walls to build? All rooms are identical in size and have walls painted Red.



11. A storage bin is to be constructed by removing a sector with a central angle, θ, from a circular piece of tin of radius 5ft and folding the remainder of tin to form a cone. What should θ be in order to obtain a maximum volume of a storage bin formed in this fashion? (Hint: Find an equation for Volume in terms of θ in radians. Plot this function on a reasonable window and find the maximum numerically.) Box your final Volume equation as a function of θ, write down your graphing window (x and y), and give your final answer in radians and degrees to three decimal places. Did you get the same answer as Farmer Leibniz? If not, start over, this time more correctly.