WORKSHEET: AP CALCULUS AB NAME_____

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For each of the following, define your variables, write an equation representing the quantity to be maximized or minimized and solve the problem. Verify if it is a maximum or minimum using the 2nd derivative test when easy, otherwise use the 1st derivative test.

1) A man wants to plant a rectangular garden along one side of his house, with a picket fence on the other three sides of the garden. Find the dimensions of the largest garden that can be enclosed using 40 feet of fencing.

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2) The manager of a department store wants to build a 600- square foot rectangular enclosure on the store's parking lot in order to display some equipment. Three sides of the enclosure will be built of redwood fencing, at a cost of $7 per running foot. The fourth side will be built of cement blocks, at a cost of $14 per running foot. Find the dimensions of the enclosure that minimizes the total cost of the building materials.

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3) The volume of an open rectangular box with a square base is 32 cubic inches. Find the dimensions of the box with minimum surface area.

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4) A large soup can is to be designed so that the can will hold 16π cubic inches of soup. Find the radius and height such that the amount of metal needed is as small as possible.

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5) A closed rectangular box with a square base and a volume of 12 cubic feet is to be constructed using two different types of materials. The top is made of a metal costing $2 per square foot and the remainder of wood costing $1 per square foot. Find the dimensions of the box for which the cost of materials is minimized.

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6) A **long** (very long!) rectangular sheet of metal 30 inches wide is to be made into a gutter by turning up strips vertically along the two sides. How many inches should be turned up on each side so as to maximize the amount of water that the gutter can carry? (Hint: Maximize the area of a cross section of the gutter)

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7) An open box is to be made from a 16 inch by 30 inch piece of cardboard by cutting out squares of equal size form the four corners and bending up the sides. What size should the squares be to obtain a box with largest possible volume?

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8) Find the radius and height of the right-circular cylinder of largest volume that can be inscribed in a right-circular cone with radius 6 inches and height 10 inches. (Hint: need similar triangles – look at cross sections)

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9) A rectangle has its two lower corners on the x-axis and its two upper corners on the curve $y = 16 - x^2$. For all such rectangles, what are the dimensions of the one with the largest area? (Hint: graph $y = 16 - x^2$ first)

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10) Find the lengths of the sides of the isosceles triangle with perimeter 12 and maximum area. (Hints: Watch the domain! Remember that the altitude drawn to the base of an isosceles triangle will bisect the base).

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