Calculus I Name:_____

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Quiz 8

Dec. 12, 2007

1. (10 pts) An automobile dealer is selling cars at a price of \$22,000. The demand function is $D(p) = 2(30 - 0.001p)^2$, for $0 \le p \le 30000$, where p is the price of a car. Should the dealer raise or lower the price to increase the revenue? What is the price that makes the maximum revenue? (Revenue function: $R(p) = p \cdot D(p)$)

   $R(p) = p \cdot D(p) = 2p(30 - 0.001p)^2$ and

   $R'(p) = 2(30 - 0.001p)^2 - 0.004p(30 - 0.001p) = (60 - 0.006p)(30 - 0.001p)$.

   $R'(22000) = 6(10 - 22)(30 - 22) < 0 \Rightarrow$ the dealer should lower the price.

   Critical number: $R'(p) = 0 \Rightarrow p = 10000 \quad \text{or} \quad 30000$.

   Since $R(10000) = 2 \cdot 10000 \cdot (20)^2 = 800000$, $R(30000) = 0$ and $R(0) = 0$, $p = 10000$ makes the maximum revenue.

2. (10 pts) For a small company spending \$ x thousand per year in advertising, suppose that annual sales in thousands of dollars equal $s(x) = 80 - 20e^{-0.04x}$. If the current advertising budget is $x = 40$ and the budget is increasing at a rate of \$ 1500 per year, find the rate of change of sales.

   Note that the rate of change of sales per year is $\frac{ds}{dt} = \frac{ds}{dx} \cdot \frac{dx}{dt}$.

   The budget is increasing at a rate of \$ 1500 per year $\Rightarrow \frac{dx}{dt} = +1500/1000 = +1.5$

   $s'(x) = -20 \cdot (-0.04)e^{-0.04x} = 0.8e^{-0.04x}$ and $s'(40) = 0.8e^{-1.6}$.

   the rate of change of sales per year is $\frac{ds}{dt} = 1.5 \cdot 0.8e^{-1.6} = 1.2e^{-1.6}$.