

Group Quiz 5

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Math 148 – Fall 2011

Name: _____

No work = no credit**No calculators (or at least not too much)**1.) Differentiate and simplify $f(x) = e^{-4x^2} + \ln(x^3\sqrt{x^5 - 3})$

$$= e^{-4x^2} + 3\ln x + \frac{1}{2}\ln(x^5 - 3)$$

$$= -8xe^{-4x^2} + \frac{3}{x} + \frac{1}{2} \cdot \frac{5x^4}{x^5 - 3}$$

2.) Suppose the weekly demand function for a product is $D: q = -1 + \frac{5000}{1+e^{2p}}$ where p is the price in thousands of dollars and q is the number of units demanded. Find and interpret the elasticity of demand when the price is \$1000.

$$q(1) = 595.$$

$$\text{so } \eta = -\frac{1}{\frac{1000}{595}} = -1.76$$

$$\frac{dq}{dp} = \frac{-5000 \cdot 2e^{2p}}{(1+e^{2p})^2}$$

$$= \frac{-10000e^{2p}}{(1+e^{2p})^2}$$

$$\text{and } \frac{dq}{dp} = -1050 \text{ when } p = 1 (\$1000).$$

There is an elastic demand of 1.76 which means if the price increases by about 1%, the demand decreases about 1.76%.

3.) If the daily demand for a product is given by the function $D: p+q=1000$ and the daily supply before taxation is $S: p = \frac{q^2}{30} + 2.5q + 920$, find the tax per item that maximizes tax revenue. Find the tax revenue.

$$\text{Solve } D = S + t$$

$$\Rightarrow 1000 - q = \frac{q^2}{30} + 2.5q + 920 + t \quad \begin{matrix} \diagdown & \diagup \\ - & + \end{matrix} \rightarrow q$$

$$\Rightarrow t = -\frac{q^2}{30} - 3.5q + 80$$

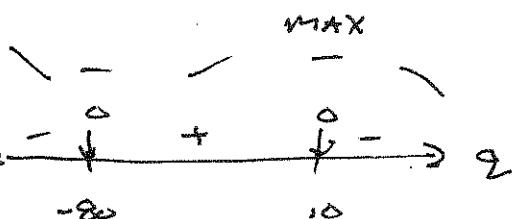
and the Total tax is:

$$T(q) = q \cdot t = -\frac{1}{30}q^3 - 3.5q^2 + 80q$$

$$\Rightarrow T'(q) = -\frac{1}{10}q^2 - 7q + 80$$

$$= -\frac{1}{10}(q^2 + 70q - 800)$$

$$= -\frac{1}{10}(q+80)(q-10)$$



max when $q = 10$

$$t = 41.67$$

$$T = 416.67$$

The max tax revenue of \$416.67 occurs when a tax of \$41.67/item is levied.