Group Quiz 5
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Math 148 – Fall 2011

Name: ______________________

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No work = no credit

No calculators (or at least not too much)

1.) Differentiate ~~and simplify~~ $f(x) = e^{-4x^2} + \ln\left(x^3\sqrt{x^5 - 3}\right)$

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

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

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

$q(1) = 595.$

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

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

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

so $\eta = -\frac{\overset{1}{\cancel{1000}}}{595} \cdot -1050$

$= 1.76$

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.

solve $D = S + t$

$\Rightarrow \quad 1000 - q = \frac{q^2}{30} + 2.5q + 920 + t$

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

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

T': $-$ $\quad$ $+$ $\quad$ $-$ $\quad q$

$-80 \qquad 10$

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.