Math 1030 # Workshop #3 **Due: July 17^{th}, 2015**

Name: ______________________________

1. Stewart sells specialty bicycles. He has collected the following data about a particular bike:

Bikes Sold	50	100	200	300
Demand Price	$1,925	$935	$960	$1,155
Supply Price	$480	$520	$750	$1,100

For example, if Stewart charges $935 per bike, he can expect to sell 100 bikes. He can obtain 100 of these bikes for $52,000 (i.e. $520 a piece).

(a) Use the table of data to find supply and demand price functions. Use a **cubic** model for the demand function and a **quadratic** model for the supply function.

Demand function: $p_d =$ ______________________________

Supply function: $p_s =$ ______________________________

The market equilibrium is $(q_E, p_E) = \big($ ______________ , ______________ $\big)$.
[Round the quantity to 3 decimal places and the price to dollars and change.]

If Stewart charges $1,500 per bike, how many can he expect to sell? ____________
[Round to 3 decimal places.]

If Stewart wants to sell 250 bikes, what will his (average supply) cost per bike be? $____________

(b) Use your model for the demand function to find a revenue function. Use your supply function to model the variable cost per bike and the fact that Stewart has fixed costs of $10,000 to find his cost function. Finally, use your revenue and cost functions to find profit, marginal revenue, marginal cost, and marginal profit functions.

Stewart has _____ break even points. These occur at $q =$ ____________________ bikes.
[Round all break even quantities to 3 decimal places.]

Stewart's 75^{th} bike brings in $______________ revenue.

The 75^{th} bike cost him $______________.

Stewart's marginal profit is $0 when $q =$ ____________________ bikes.
[List **all** quantities where $MP(q) = 0$. Round quantities to 3 decimal places.]

Stewart will maximize his profit if he sells __________ bikes at a price of $______________ each.

His maximum possible profit is $______________________.

(c) Does Stewart's cost function have a minimum? In a few sentences explain why or why not.

2. Use Excel to compute the following limits. If the limit does not exist write "DNE".

(a) Let $f(x) = \begin{cases} \ln(x^2+1) & \text{if } x \le 2 \\ e^{-2x} & \text{if } x > 2 \end{cases}$

$\lim_{x \to 2} f(x) =$ ________________

$\lim_{x \to 1} f(x) =$ ________________

(b) $\lim_{x \to -3} \dfrac{(x+3)(x+5)}{\ln|x+4|} =$ ________________

[*Note:* $|x+4|$ is the absolute value of $x+4$. In Excel, "ABS" is the absolute value function.]

3. Recall that the **derivative** of $f(x)$ is defined to be

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

where $\dfrac{f(x+h) - f(x)}{h}$ is called the **difference quotient** of $f(x)$.

Let $f(x) = (x-4)^{2/3}$.

Warning: Excel doesn't handle negative cube roots well. If you get "NUM!" errors, try this fix: You will need to enter $f(x)$ as $((x-4)^2)^{1/3}$. If x is in A1, this is "`=((A1-4)^2)^(1/3)`".

(a) Compute the difference quotient of $f(x)$ when $x = 2$ and $h = 0.1$.

$\dfrac{f(2+0.1) - f(2)}{0.1} =$ ________________

Now use Excel to compute the limit as $h \to 0$. This shows that $f'(2) \approx$ ______________.

(b) Use Excel to repeat the previous part for $x = 4$ (try to compute $f'(4)$). Does the limit ($h \to 0$) of the difference quotient at $x = 4$ exist? If it does exist, what is it? If it does not exist, why not? Explain your answer in a sentence or two.