**Math 1030** # Workshop #3 **Due: July $22^{\text{nd}}$, 2011**

## Name: ______________________________

**1.** Stacy is a travel agent. Sometimes she arranges accommodations for large groups to come to Boone. After calling around to hotels and surveying potential travelers, she has collected the following data:

| Hotel Rooms Rented | 1 | 20 | 50 | 100 |
|---|---|---|---|---|
| Demand Price | $200 | $125 | $110 | $85 |
| Supply Price | $25 | $50 | $45 | $95 |

So for example, if Stacy offers rooms at a rate of $125 per night, she should to rent about 20 rooms. However, she can obtain 20 rooms at an average rate of $50 per room per night.

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

Demand function: $p_d =$ ______________________________

Supply function: $p_s =$ ______________________________

The market equilibrium is $(q_E, p_E) = \Big($ __________ , __________ $\Big)$.

If Stacy wants to rent 75 rooms, what price should she set for a hotel room? $__________

If she aquires 75 rooms, what will her (average) price per room be? $__________

(b) Use your model for the demand function to find a revenue function. Use your supply function to model the variable cost per room and the fact that Stacy has fixed costs of $450 per day to find her cost function. Finally, use your revenue and cost functions to find profit, marginal revenue, marginal cost, and marginal profit functions.

Stacy has _____ break even points.

These occur when she rents ______________________________ rooms.

Stacy's $15^{\text{th}}$ room brings in $______________ (in revenue) per day.

Stacy maximizes her profit when she rents __________ hotel rooms.

The corresponding optimal price (for the travelers) is $______________ per room per day.

Her maximum possible profit is $______________ per day.

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

(a) $$\lim_{x\to 3} \frac{x^3 - 3x^2 + x - 3}{|x-3|} = \underline{\hspace{4cm}}$$

*Note:* The denominator is in absolute value bars. In Excel, "=ABS(A1)" would compute the absolute value of the number in cell A1.

(b) $$\lim_{x\to 0} \frac{\ln(x+1)}{x} = \underline{\hspace{4cm}}$$

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

Let $f(x) = x^x$. Compute the difference quotient of $f(x)$ when $x = 2$ and $h = 0.5$.

$$\frac{f(2+0.5) - f(2)}{0.5} = \underline{\hspace{4cm}}$$

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

Finally, redo these calculations when $x = 0.2$ and $h = -0.1$.

$$\frac{f(0.2-0.1) - f(0.2)}{-0.1} = \underline{\hspace{4cm}}$$

$f'(0.2) \approx$ ________________