Math 1030 (Section 102) **Final Exam — Part 1** **June 25^{th}, 2010**

Name: _____ **Be sure to show your work!**

1. (____/8 points) Find the derivative. Don't worry about simplifying your answers.

(a) $f(x) = \dfrac{e^x + 5x + 1}{\sqrt{x} - 4x^3} + \ln\left(x^5 e^{2x}\right)$

(b) $f(x) = e^{3x} + (2x+1)^{10}\ln(x)$.

2. (____/12 points) Integration. **Please simplify answers.**

(a) $\displaystyle\int 12x^3 - 5\sqrt{x} + \frac{1}{x^3} + 7\,dx$

(b) $\displaystyle\int e^{-4x} + \frac{2x+1}{x^2+x+3}\,dx$

(c) Suppose that $g'(x) = (5x-10)^{100}$ and $g(2) = 123$. Find $g(x)$.

Math 1030 (Section 102) **Final Exam — Part 2** **June 25^{th}, 2010**

Name: _____ **Be sure to show your work!**

3. (____/10 points) Candy owns a paddle boat rental shop on the beach. She has collected the following demand data (q is the number of rentals and p is the price of renting a paddle boat for the afternoon):

$q =$	1	5	25	50
$p =$	\$40	\$35	\$20	\$10

In addition, Cindy's daily fixed costs are \$300 and variable costs are \$5 per boat.

(a) Find an exponential model for Cindy's demand price data.

The exponential trendline is $p(q) =$ _____.

(b) Cindy's daily cost function is $C(q) =$ _____.

(c) Cindy has _____ break even points. They are located at $q =$ _____.

4. (____/10 points) The UN has collected the following data about Billodonia:

$x =$	0.2	0.6	0.8
$L(x) =$	0.05	0.4	0.7

Where $L(x) = y$ mean that the poorest x percent of Billodonia receive y percent of the income.

(a) Model the Lorenz curve for Billodonia using a **quadratic** function.
Hint: Don't forget to include values for 0 and 1, and remember to check the "Set Intecept" box.

$L(x) =$ _____

(b) Use your model for $L(x)$ to predict how much income the poorest half of the country receives.

$L(0.5) =$ _____ (3 decimals please).

(c) The Gini index of Billodonia is _____ (3 decimals please).

5. (____/10 points) Warren and Wendy just bought a house. They took out a \$150,000 mortgage. Their bank gave them a 30 year mortgage with a 5% (compounded monthly) interest rate.

(a) Their mortgage payment is \$ _____ a month.

(b) Fill out the 180^{th} line of their amortization table and write out the formulas you used in the next line:

Month	Beginning Balance	Payment	Interest	Amount to Principle	End Balance
180					
Formulas:					

(c) How long will it take Warren and Wendy to pay off their house if they increase their payment to \$1,300 a month?

_____ years and _____ months.

6. (____/10 points) Joy's store sells 2000 printers each year. When Joy places an order of less than 300 printers, she pays \$50 for each printer. It costs her \$250 to place such an order and her inventory costs are \$5 per printer per year (based on average inventory with all the standard assumptions). On the other hand, when Joy places an order of 300 or more printers, she pays \$40 per printer. However, it costs her \$500 to place a large order and her inventory costs increase to \$10 per printer per year.

(a) Joy's annual cost function is $C(x) = \begin{cases} \\ \\ \\ \end{cases}$

(b) List **all** of the locations of critical points of $C(x)$ — including negative x's.

The critical points of $C(x)$ are located at $x =$ _____.

(c) Joy's ideal EOQ is _____ (3 decimals please).

Her ideal minimal annual cost is $C(x) =$ \$ _____.

Show you work for parts (b) and (c):

7. (____/10 points) Given the following demand and supply functions:

$$p_d(q) = 300e^{-0.05q} - 0.2q \qquad \text{and} \qquad p_s(q) = 10\sqrt{q} + 5$$

(a) Find the (exact) area under the supply curve: $p = 10\sqrt{q} + 5$ for $2 \leq q \leq 5$.

Area = _____ (3 decimals please).

Show your work:

(b) The market equilbrium is $(q_E, p_E) =$ _____ (3 decimals please).

(c) Find the optimal producer surplus. The producer surplus is _____.

Show your work:

8. (____/10 points) Elasticity

(a) If $p(q) = -2\ln(q) + 10$ is our demand function and $q = 2$, then point elasticity is

$\varepsilon =$ _____ (3 decimals please). This is Elastic / Inelastic / Unitary.

Show your work:

(b) Suppose we know that $\varepsilon = 0.75$ at some quantity and this quantity is decreased by 3%.

Then the price p will Increase / Decrease _____% (percent).

Also, the revenue will Increase / Decrease _____% (percent).

Show your work:

9. (____/10 points) Fred's Bowl-a-rama rents a lot of shoes. In fact, Fred rents about 500 pairs of shoes each day. Fred has noticed that the shoe sizes that he rents are normally distributed with a mean size of 8 and standard deviation of 2. *Note:* Shoes sizes go up by increments of 1/2.

(a) How many pairs of shoes sized 12 and larger does Fred rent each day? _____ pairs of shoes.

Show your work:

(b) Rentals of size _____ and smaller account for 25% of Fred's business.

Show your work:

10. (____/10 points) English Petrol has a broken oil well valve which is spilling oil into a nearby body of water. It is leaking at a rate of $S(t) = te^{-0.02t^2}$ million gallons of oil per day where t is the number of days since the spill began.

(a) When will oil be leaking out at the fastest rate? _____ days.

Show your work:

(b) How much oil will leak out during the sixth day of the spill? _____ million gallons.

Show your work:

(c) How long will it take the first 4 million gallons of oil to spill out? _____ days.

Show your work: