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Math16A Sample Final Exam, Fall 2009

This is a closed book, closed notes exam. You need to justify every one of your answers unless you are asked not to do so. Completely correct answers given without justification will receive little credit. Look over the whole exam to find problems that you can do quickly. You need not simplify your answers unless you are specifically asked to do so.

Problem	Maximum Score	Your Score
1	12.5	
2	12.5	
3	12.5	
4	12.5	
5	12.5	
6	12.5	
7	12.5	
8	12.5	
Total	100	

Your Name & SID: _____

Your Section & GSI: _____

1. (a) Compute the following indefinite integral:
$\int \left(x^2 + 1/x - e^{4x}\right) dx.$

   (b) Compute the following definite integral:
$\int_1^2 \left(\sqrt{2x+1} - x^{-2}\right) dx.$

2. (a) Suppose that the marginal revenue function for a company is 100 - x. Find the additional revenue received from doubling production if currently 10 units are being produced.

   (b) Suppose that the marginal cost is $2x + 0.3x^2$, with fixed costs at 30. Find the total cost if 10 units are being produced.

3. (a) Compute the area of the region between the curves $y = x + 1$ and $y = -x^2 - 1$ from $x = 0$ to $x = 1$.

   (b) Compute the area enclosed by the curves $y = 1/2x^2 + 1$ and $y = -1/2x^2 + 3x - 1$.

4. Suppose that a lake is stocked with 100 fish. After 1 month, there are 150 fish in the lake. An ecological study predicts that the lake can support 600 fish. Use a logistic growth curve to estimate the number of fish in the lake after 1 year.

5. (a) Find the average value of the function $f(x) = 1/x$ over the interval $-3 \leq x \leq -1$.

   (b) Use a Riemann sum to estimate the following sum for large enough values of n:

$$\sqrt{1+n} + \sqrt{2+n} + \sqrt{3+n} + \cdots + \sqrt{n+n}.$$

6. If the demand equation for a monopolist is $p = 150 - 0.02x$ and the cost function is $C(x) = 10x + 300$, find the value of x that maximizes the profit.

7. (a) For $u = \sqrt{x}$ and $\dfrac{dy}{du} = u^2$, find $\dfrac{dy}{dx}$.

   (b) For $g(x) = x^2$ and $f'(x) = x\sqrt{x+1}$, find a formula for $\dfrac{d}{dx}f(g(x))$.

8. Given function $f(x) = \ln(x^2 + 1)$.

   (a) Find the relative and absolute maximum/minimum of $f(x)$ if they exist.

   (b) Sketch the graph of this function.