Prince Sultan University
Department of Mathematics and Physical Sciences

Math 211
Final Examination
Semester I, Term 111
Wednesday, January 18, 2012

Time Allowed: 120 minutes

Name:	Instructor's Name
Student Number:	

Important Instructions:

1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You may NOT use notes or any textbook.
4. There should be NO talking during the examination.
5. Your exam will be taken immediately if your mobile phone is seen or heard.
6. Looking around or making an attempt to cheat will result in your exam being cancelled.
7. This examination has 10 problems, some with several parts. Make sure your paper has all these problems.

Problems	Max points	Student's Points
1,2	17	
3,4	17	
5,6	14	
7,8	16	
9,10	16	
Total	**80**	

Q.1 (4+5 points) Evaluate

a) $\lim\limits_{x \to 3} \dfrac{-2x^2 + 5x + 3}{x^2 - 9}$.

b) $\lim\limits_{x \to -\infty} \dfrac{1 - 2x^3}{x - 3x^2 + 1}$. Show all your work.

Q.2 (3+5 points) The demand function of a particular commodity is $q = D(p) = 3000\, e^{-0.04p}$ units, where p is the price in dollars per unit for which all q units will be sold.

a) Find the revenue $R(p)$ obtained by selling q units at the unit price p.

b) For what value of p is revenue maximized?

Q.3 (7 points) A governmental agency determines that the Lorentz curve for the distribution of income for contractors is given by the function $L(x) = 0.55x^2 + 0.45x$. Find the Gini index for this curve. Interpret your answer.

Q.4 (6+4 points)

a) Find an equation for the tangent line to $x^2y^3 - 2xy = 6x + y + 1$ at $(0,-1)$.

b) How much money should be invested today at an annual interest rate of 7% compounded continuously so that 20 years from now it will worth $20,000.

Q.5 (5+4 points) Consider the function $f(x) = -2x^3 + 3x^2 + 12x - 5$.

a)   Find the local extrema and determine intervals of increase and decrease.

b)   Determine intervals of concavity and find the inflection point, if any.

Q.6 (5 points) Find the derivative $\dfrac{dy}{dx}$ for the following function $y = \ln\left(\dfrac{x^2 - 1}{x^3\sqrt{x+1}}\right)$.

Q.7 (6 points) Find the region of the area bounded by the curves $y = x^2 - 2x$ and $y = -x^2 + 4$.

Q.8 (4+6 points) Evaluate the following integrals:

a) $\int \dfrac{2x\ln(x^2 + 1)}{x^2 + 1}\, dx$

b) $\int\limits_0^1 x^2 e^{-x}\, dx.$

Hint: Use integration by parts.

Q.9 (6 points) The marginal revenue derived from producing q units of a certain commodity is $R'(q) = 4q - 1.2q^2$ dollars per unit. If the revenue derived from producing 20 units is $30,000, how much revenue should be expected from producing 40 units?

Q.10 (6+4 points) Given the function $f(x, y) = (2x^2 + y^2 + 3)^{\frac{1}{2}}$.

a)   Find the first partial derivatives f_x and f_y and show that $yf_x - 2xf_y = 0$.

b)   Evaluate $f_{xy}(4,1)$.