Prince Sultan University
Department of Mathematics and Physical Sciences

Math 211
Major Exam II
Semester I, Term 111
Saturday, December 24, 2011

Time Allowed: 80 minutes

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 7 problems, some with several parts. Make sure your paper has all these problems.

Questions	Q.1	Q.2	Q.3	Q.4	Q.5	Q.6	Q.7	Total
Marks								
Maximum Marks	6	7	14	5	7	6	5	50

Question.1 (3+3 points) Suppose that the total cost in dollars of manufacturing *q* units is $C(q) = x^2 + 10xe^{-x}$.

a) Use marginal analysis to estimate the cost of manufacturing the 11-th unit.

b) Compute the actual cost of manufacturing the 11-th unit.

Question.2 (3+4 points) Evaluate the integrals:

a) $\int t^{-\frac{1}{2}}(t^2 - t + 2)dt$.

b) $\int \frac{x^2}{\sqrt{x+5}}dx.$

Question.3 (2+5+4+3 points) Consider the function $f(x) = x^4 + 4x^3 + 4x^2$. Find

a) The domain and the *x* and *y* intercepts.

b) The critical points, intervals of increase and decrease and the relative extrema.

c) The intervals of concavity and the inflection points.

d) Sketch the graph.

Question.4 (5 points) Given the price $p(q) = 37 - 2q$ at which *q* units of a particular commodity can be sold and the total cost $C(q) = 3q^2 + 5q + 75$ of producing *q* units. Find the profit function $P(q)$ and determine the level of production *q* at which $P(q)$ is maximized.

Question.5 (3+4 points) Write an expression to $\frac{dy}{dx}$ if

a) $5x - x^2 y^3 = 2y$.

b) $y = \sqrt[4]{\frac{2x+1}{1-3x}}$. Hint: Use logarithmic differentiation.

Question.6

a) (3 points) Suppose that $5000 is invested at an annual rate of 10%. Compute the balance after 10 years if the interest is compounded semiannually.

b) (3 points) How quickly will the money double if it is invested at an annual rate of 7% compounded continuously.

Question.7 (3+2 points) An oil spill in the ocean is roughly circular in shape with radius $R(t)$ feet *t* minutes after the spill begins. The radius is increasing at the rate $R'(t) = \dfrac{21}{0.07t + 5}$, ft/min. Find an expression for the radius $R(t)$ where $R(0) = 0$. What is the area $A = \pi R^2$ of the spill after 1 hour.