Prince Sultan University

Math 211
Major Exam 2
First Semester, Term 131
Thursday, December 19, 2013

Time Allowed: 90 minutes

Student Name:_____   _____   _____

Student ID #: _____

Serial Class #:_____   Section #:   229

Instructor's Name: Dr. Aiman Mukheimer

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. Talking during the examination is NOT allowed.
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 17 problems, some with several parts. Make sure your paper has all these problems.

Problems	Max points	Student's Points
1,2,3,4	18	
5,6,7,8,9	21	
10,11	16	
12,13,14,15,16	25	
17	20	
Total	100	

Q1. (4 point) Find an equation for the tangent line to the curve $x^3 + xy + y^3 = x$ at the point (1, 0).

Q2. (6 points) Suppose the total cost in dollars of manufacturing x units of a particular commodity is $C(x) = \frac{5}{9}x^2 + 5x + 73$ and the unit price at which all x units will be sold is $p(x) = -2x^2 - 15x + 6000$.

a) Find the marginal cost and the marginal revenue.

b) Use Marginal cost to estimate the cost of manufacturing the 21st unit.

c) What is the actual cost of manufacturing the 21st unit?

Q3. (4 points) Find $\frac{dy}{dx}$, where $\sqrt{x} + \sqrt{y} = xy$

Q4. (4 points) When the price of a certain commodity is p dollars per unit, the manufacturer is willing to supply x hundred units, where $3p^2 - x^2 = 11$. How fast is the demand x changing with respect to time when the price is \$5 per unit and is decreasing at the rate of 30 cents per months?

Q5. (3 point) A company has profit defined by $p(t) = 4t^2 - 30t$. Does the profit increase or decrease at $t = 2$?

Q6. (4 points) Find the intervals of increase and decrease for the function $f(x) = \sqrt{x^2 + 1}$

Q7. (4 points) Find all critical numbers of the function $f(x) = \dfrac{x-1}{x^2+3}$.

Q8. (5 points) Let $f(x) = 2x^3 - 3x^2 - 12x + 13$. Find all critical points of f and use the second derivative test to classify each as a relative maximum, a relative minimum, or neither.

Q9. (5 points) A national consumers' association determines that x years after its founding in 1998. It will have $P(x)$ members, where $P(x) = 100(2x^3 - 45x^2 + 264x)$. What were the largest and smallest membership levels between 2008 and 2013?

Q10. (10 points) Graph $f(x) = x^3 + 3x^2 - 2$
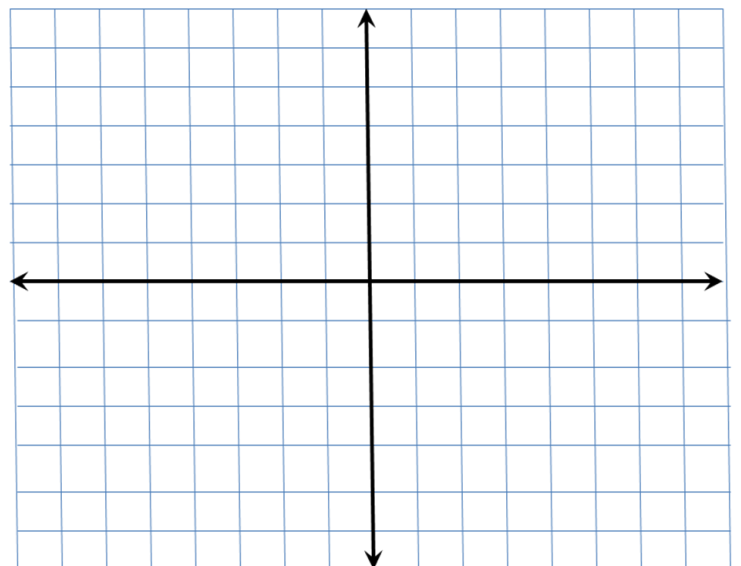
Q11. (6 points) Suppose the demand function is $D(p) = 200 - p^2$ and price p for a certain commodity
i. Calculate the elasticity of demand when the price is $p = 10$. Interpret your answer.

ii. Determine whether the demand is elastic, inelastic, or of unit elasticity at $p = 10$

Q12. (5 points) How much money should be invested today at 5 percent **compounded continuously** so that 10 years from now it will be worth $10,000?

Q13. (5 points) Suppose $1,500 is invested at an annual interest rate of 8 percent **compounded quarterly**. Compute the balance after 12 years.

Q14. (5 points) Find $\dfrac{dy}{dx}$ where $y = \dfrac{e^{5x}(2x-1)^9}{(x^3+5)^3(4-7x)}$

Q15. (5 points) Determine the area of the region bounded by the curves $y = 1 + 4x - x^2$ and $y = 1 + x^2$

Q16. (5 points) Find the average value of $f(x) = \dfrac{x^2+1}{x}$ over the interval $1 \le x \le e^2$

Q17. (20 points) Evaluate the following integrals:

a) $\int x^3 \left(2x + 5 - 3\sqrt{x}\right) dx$

b) $\int_0^1 (e^{2t} + e^{-3t}) dt$

c) $\int x (x+7)^8 dx$

d) $\int_e^{e^2} \frac{1}{x \ln x} dx$

e) $\int_1^4 \frac{(\sqrt{x} - 1)^{3/2}}{\sqrt{x}} dx$