Prince Sultan University

Math 211
Final Exam
Second Semester, Term 132
Saturday, May 24, 2014

Time Allowed: 120 minutes

Student Name:_____ _____ _____

Student ID #: _____

Serial Class #:_____ Section #: 225

Instructor's Name: Dr. Aiman Mukheimer

Important Instructions:

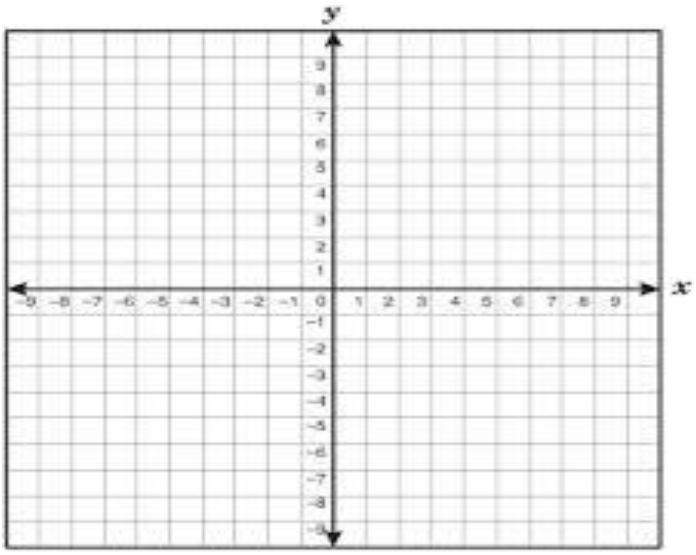
1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You may NOT use notes or any textbook.
4. Talking during the examination is NOT allowed.
5. Your exam will be taken immediately if your mobile phone is seen or heard.
6. Looking around or making an attempt to cheat will result in your exam being cancelled.
7. This examination has 14 problems, some with several parts. Make sure your paper has all these problems.

Problems	Max points	Student's Points
1,2,3	15	
4,5,6	15	
7,8,9	18	
10	12	
11,12,13,14	20	
Total	80	

Q1. (5 points) Sketch the graph of the function

$$f(x)=\begin{cases} x^2+x-3 & if \quad x<1 \\ 1-2x & if \quad x\geq 1 \end{cases}.$$

Include all x and y intercepts.



Q2. (6 point) Find the limit if it exists:

1. $\lim\limits_{x\to 1}\dfrac{x^2+x-2}{x^2-1}$

2. $\lim\limits_{x\to -\infty}\dfrac{x-6}{x^2+15}$

Q3. (4 points) Find the values of the constant A such that the function $f(x)$ continuous for all x.

$$f(x)=\begin{cases} \dfrac{Ax}{x^2-x} & if \quad x<0 \\ 5+Ax & if \quad x\geq 0 \end{cases}$$

Q4. (6 points) The manager of a company that produces graphing calculators determines that when x thousand calculators are produced, they will be sold when the price is $p(x) = \dfrac{1000}{0.3x^2 + 8}$ dollars per calculator.

1. At what rate is demand $p(x)$ changing with respect to the level of production x when 3000 calculators are produced?

2. At what rate is revenue changing with respect to the level of production x when 3000 calculators are produced? Is revenue increasing or decreasing at this level of production

Q5. (3 points) Find $f^{(3)}(x)$ if $f(x) = \sqrt{x} - \dfrac{1}{2x} + \dfrac{x}{\sqrt{2}}$.

Q6. (6 points) Suppose the total cost in dollars of manufacturing x units of a particular commodity is $C(x) = \frac{1}{4}x^2 + 43$ and the unit price at which all x units will be sold is $p(x) = \dfrac{3+2x}{1+x}$.

a) Find the marginal cost and the marginal revenue.

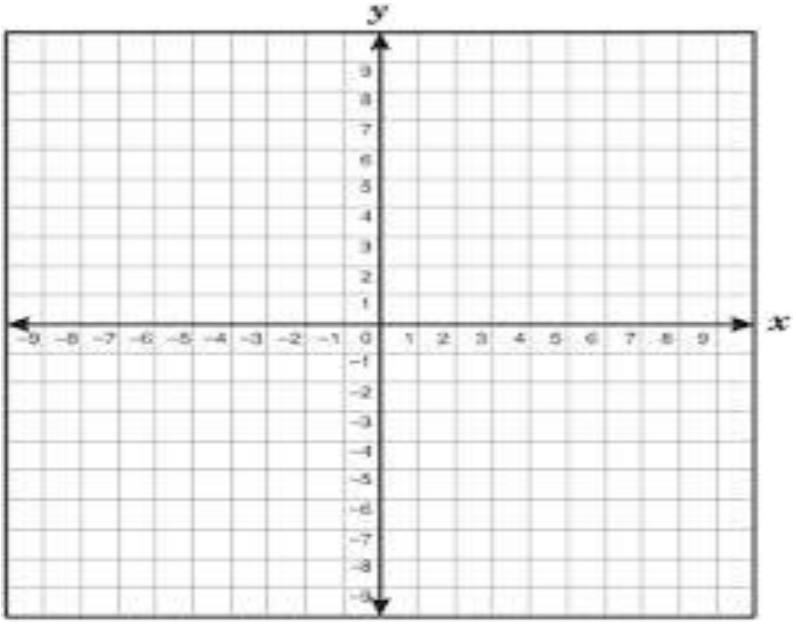
b) Use Marginal cost to estimate the cost of manufacturing the 21st unit.

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

Q7. (5 points) Use implicit differentiation to find the slope of the line that is tangent to the curve $(x^2+2y)^3 = 2xy^2 + 64$; at $(0,2)$.

Q8. (4 points) Find the intervals of increase and decrease for the function $f(x) = 3x^5 - 5x^3 + 4$

Q9. (9 points) Let $f(x) = x^3 - 3x^2 + 3x + 1$. Find all critical points of *f* and determine where the function is increasing and decreasing, and where its graph is concave up and concave down. Find the relative extrema and inflection points, and then **sketch** the graph of the function.



Q10. (12 points) Evaluate the following integrals:

a) $\int \frac{y^2}{(y^3+5)^2}\,dy$

b) $\int_2^{e+1} \frac{x}{x-1}dx$

c) $\int \frac{1}{x^2}\left(\frac{1}{x}-1\right)^{2/3}\,dx$

d) $\int_1^e \frac{\ln x}{x^2}\,dx$

Q11. (4 points) Suppose the demand function is $D(p) = \sqrt{400 - 0.01p^2}$ and price p for a certain commodity

i. Calculate the elasticity of demand when the price is $p = 120$. Interpret your answer.

ii. Determine whether the demand is elastic, inelastic, or of unit elasticity at $p = 120$

Q12. (4 points) Compute f_x and f_y for $f(x, y) = xe^{-2y} + ye^{-x} + xy^2$

Q13. (6 points) Determine the area of the region bounded by the curves $y = x^2 - 2x$ and $y = -x^2 + 4$

Q14. (6 points) A manufacturer has found that marginal cost is $(0.1q + 1)e^{0.03q}$ dollars per unit when q units have been produced. The total cost of producing 10 units is \$200. What is the total cost of producing the first 20 units?