Prince Sultan University

Math 211
Final Exam
First Semester, Term 131
Thursday, January 2nd, 2014

Time Allowed: 120 minutes

Student Name:_____ _____ _____

Student ID #: _____

Serial Class #:_____ Section #: 229

Instructor's Name: Dr. Aiman Mukheimer

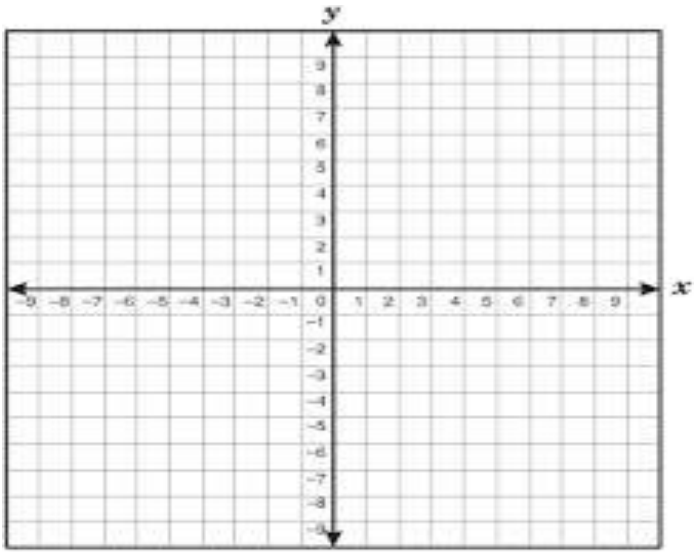
Important Instructions:

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

Problems	Max points	Student's Points
1,2,3	15	
4,5,6,7	19	
8,9,10,11	17	
12,13,14	14	
15	16	
16,17,18,19	19	
Total	100	

Q1. (4 points) Graph the quadratic function

$f(x) = x^2 + 2x - 8$



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

1. $\lim_{x \to 5} \dfrac{x^2 - 3x - 10}{x - 5}$

2. $\lim_{x \to \infty} \dfrac{x^3 - 7x - 6}{13 - 5x^3}$

Q3. (5 points) Find the values of the constant *A* such that the function *f*(*x*) continuous for all *x*.

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

Q4. (5 points) As advances in technology result in the production of increasingly powerful, compact calculators, the price of calculators currently on the market drops. Suppose that x months from now, the price of a certain model will be P dollars per unit, where $P(x) = 40 + \frac{30}{x+1}$.

1. What will be the price 5 months from now?

2. By how much will the price drop during the fifth month?

Q5. (4 points) Find $h'(-3)$ if $h(x) = [3x^2 - 2g(x)][g(x) + 5x]$ where $g(-3) = 1$ and $g'(-3) = 2$.

Q6. (4 points) Find the second derivative of $f(x) = (4\sqrt{x} + 2x + 5)(3 - x^3)$.

Q7. (6 points) An efficiency study of the morning shift at a certain factory indicates that an average worker arriving on the job at 8:00 A.M. will have produced $Q(t) = -t^3 + 8t^2 + 15t$ units t hours later.

a) Compute the worker's rate of production.

b) At what rate is the worker's rate of production changing with respect to time at 9:00 A.M?

Q8. (5 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?

Q9. (4 points) Use implicit differentiation to find the slope of the line that is tangent to the curve $x^2 + 2y^3 = \frac{3}{xy}$; at $(1,1)$.

Q10. (4 points) Find the intervals of increase and decrease for the function $f(x) = \sqrt{x} + \frac{1}{\sqrt{x}}$

Q11. (4 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.

Q12. (4 point) Find the absolute maximum and minimum of the function $f(x)=\frac{1}{6}(x^3-6x^2+9x+1)$ on the interval $0 \le x \le 2$

Q13. (5 points) Suppose the demand function is $D(p)=\frac{3000}{p}-100$ 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 $p=10$

Q14. (5 points) The price p (dollars per unit) of a particular commodity is increasing at the rate $p'(x)=\frac{20x}{(7-x)^2}$ when x <u>hundred units</u> of the commodity are supplied to the market. The manufacturer supplies 200 units when the price is $2 per unit.

1. Find the supply function $p(x)$.

2. What price corresponds to supply of 500 units?

Q15. (16 points) Evaluate the following integrals:

a) $\int\left(5x^{2/3}-\frac{3}{x^5}+\frac{1}{3x}\right)dx$

b) $\int_{-1}^{4}\frac{x}{\sqrt{x+5}}dx$

c) $\int(x+2)\ln(x+2)\,dx$

d) $\int_{1/3}^{1/2}\frac{e^{1/x}}{x^2}dx$

Q16. (4 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?

Q17. (5 points) The average value of $f(x) = \frac{kx}{x+1}$ over the interval $1 \le x \le 3$ is 8. What is value of the constant *k*?

Q18. (6 points) Determine the area of the region bounded by the curve $y = x^3 - 3x^2 + x + 5$ and the line y = *x* + 5

Q19. (4 points) Compute f_x and f_y for $f(x, y) = 4x^6 y - 3x + e^{xy}$