Prince Sultan University

Math 211
Major Exam 1
First Semester, Term 131
Sunday, October 6, 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 16 problems, some with several parts. Make sure your paper has all these problems.

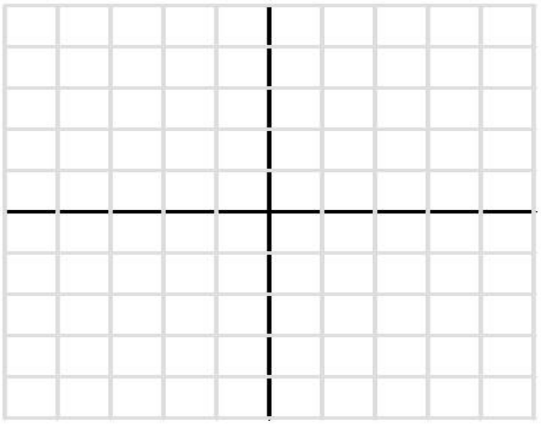
Problems	Max points	Student's Points
1,2,3,4,5	25	
6,7,8,9	25	
10,11,12	25	
13,14,15,16	25	
Total	100	

Q1. (5 points) What is the domain of the function $f(t) = \dfrac{1}{t\sqrt{1-t^2}}$?

Q2. (5 points) Where do the lines $y = 3x - 1$ and $y = 3 - 5x$ intersect?

Q3. (5 points) Temperature measured in degrees Fahrenheit is a linear function of temperature measured in degrees Celsius. Use the fact that the 0^{O} Celsius is equal to 32^{O} Fahrenheit and 100^{O} Celsius is equal to 212^{O} Fahrenheit to write an equation for this linear function. Use your function you obtained to convert 15^{O} Celsius to Fahrenheit.

Q4. (5 points) Graph the quadratic function
$f(x) = x^2 + 2x - 8$



Q5. (5 points) A manufacture can produce digital recorders at a cost of $40 apiece. It is estimated that if the recorders are sold for p dollars apiece, consumers will buy $100 - p$ of them a month. Express the manufacturer's monthly profit as a function of price.

Q6. (12 point) Find the limit if it exists:

1. $\lim_{x\to 4} \dfrac{\sqrt{x}-2}{x-4}$

2. $\lim_{x\to \infty} \dfrac{x^2-x-6}{1-x^3}$

3. $\lim_{x\to 0}(2-\dfrac{1}{x})$

Q7. (3 points) Show whether the function $f(x)=\begin{cases} x+2 & \text{if } x<4 \\ -5x-22 & \text{if } x\geq 4 \end{cases}$; is continuous at $x=4$.

Q8. (4 points) Find the values of the constant *A* such that the function *f*(*x*) continuous for all *x*.

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

Q9. (6 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 $P(x)=40+\dfrac{30}{x+1}$.

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

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

Q10. (6 point) Find the equation of the tangent line to the curve $f(x) = 1 - \frac{1}{x} + \frac{2}{\sqrt{x}}$ at $(4, \frac{7}{4})$.

Q11. (12 points) Differentiate the following functions:

1. $f(x) = \frac{2}{3}x^9 - \frac{9x}{6} + \frac{8}{3x^2} - \sqrt[5]{x^7} + \sqrt{7}$

2. $f(x) = (x-1)\frac{4-x^5}{\sqrt{x}}$

3. $f(x) = \frac{x}{x^5 - 1} + \frac{5-x}{x^5 + 1}$

Q12. (7 points) Find $h'(-3)$ if $h(x) = [3x^2 - 2g(x)][g(x) + 5x]$ where $g(-3) = 1$ and $g'(-3) = 2$.

Q13. (6 points) Find the second derivative of $f(x) = (4\sqrt{x} + 2x + 5)(3 - x^3)$.

Q14. (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?

Q15. (8 points) The gross national product (GNP) of a certain country is $N(t) = t^2 + 3t + 121$ billion dollars where *t* is the number of years after 1990.

a) At what rate were the gross national products (GNP) changing with respect to time in 2013?

b) At what percentage rate will the GNP be changing with respect to time in 2013?

Q16. (5 points) Find the equation of the line that is tangent to the curve $f(x) = \dfrac{5x^2 - 7x + 1}{5 - 4x^3}$ at (1, –1).