PRINCE SULTAN UNIVERSITY

MATH 111 CALCULUS

MAJOR EXAM 2 26TH APRIL, 2008

Start: **4:00 p.m.**
End: **5:30 p.m.**

Name: _____

I.D. _____

Section: **223**

1. Answer all questions
2. This exam consists of 1 Cover Sheet & 4 Question Sheets with 10 questions.
3. You can use a calculator, **NOT** a mobile phone.
4. No talking during the test.
5. **SHOW ALL WORKING OUT IN THE SPACE PROVIDED.**
6. **SIMPLY YOUR ANSWERS AS MUCH AS POSSIBLE**

Question No.	Max. Points	Points Scored
1,2	**14**	
3,4	**20**	
5,6,7	**22**	
8,9,10	**18**	
TOTAL	**74**	

1) [6 points] Find a value for the constant *k* such that that the function will be continuous everywhere.

$$f(x)=\begin{cases}2-4x & x<2\\ kx^2-2x-6 & x\geq 2\end{cases}$$

2) [8 points] Find the value of the following limits.

a) $\lim_{x\to 0}\dfrac{1-\cos 3h}{\cos^2 5h-1}$

b) $\lim_{x\to 0}\dfrac{\tan 3x^2+\sin^2 5x}{x^2}$

3) [10 points] Given that $y = 2x^2 + 3x$

a) Find the average rate of change over $[3,5]$.

b) Find the instantaneous rate of change of y with respect to x at an arbitrary value of x_0 using the limit of the **Difference Quotient** as $x_1 \to x_0$.

4) [10 points] Given that $f(x) = 3x^3 - 2x^2$

a) Use the limit of the **Difference Quotient** as $h \to 0$ to find $f'(x)$.

b) For the above function, find the equation of the tangent line at $x = 1$.

5) [10 points] Given that $y = \sqrt[3]{x}\left(x^2 - 3x + 2\right)$

a) Show that $\frac{dy}{dx} = \frac{7x^2 - 12x + 2}{3x^{2/3}}$.

b) the *x*-coordinate of the points on the graph at which the tangent line is horizontal.

c) the *x*-coordinate of the points on the graph at which the tangent line is vertical.

6) [6 points] Given that $y = \left(2x^7 - x^2\right)\left(\frac{x-1}{x+1}\right)$ find $\left.\frac{dy}{dx}\right|_{x=1}$

7) [6 points] Find $\left.\frac{d^4y}{dx^4}\right|_{x=1}$, where $y = \frac{6}{x^4}$

8) [6 points] Given that $f(x)=\dfrac{\cot x}{1+\csc x}$ show that $f'(x)=-\dfrac{\csc x}{1+\csc x}$.

9) [6 points] Given that $f(x)=\dfrac{\sin x}{x^2+\sin x}$ show that $f'(x)=\dfrac{x^2\cos x-2x\sin x}{(x^2+\sin x)^2}$.

10) [6 points] Find $\dfrac{dy}{dx}$, given that $y=\left[1+\sin^3\left(x^5\right)\right]^{12}$.