PRINCE SULTAN UNIVERSITY

MATH 111 CALCULUS

MAJOR EXAM 2 9th MAY 2009

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

Name: _____

I.D. _____

Instructor: _____ **Section:** _____

1. Answer all questions
2. This exam consists of 1 Cover Sheet & 5 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.

Question No.	Max. Points	Points Scored
1,2	**20**	
3	**16**	
4	**16**	
5,6,7	**16**	
8,9,10	**12**	
TOTAL	**80**	

1) [12 points] Find the value of the following limits:

a) $\lim_{x\to 0}\frac{\tan 8x}{\sin 4x}$

b) $\lim_{t\to 0}\frac{t^2}{1-\cos^2 5t}$

c) $\lim_{\theta\to 0}\frac{\tan A\theta^2+\sin^2 B\theta}{\theta^2}$

2) [8 points] Given that $y = 2x^2 - 3x$,

a) Find the average rate of change over the interval $[3,4]$.

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

3) [16 points] Find $\frac{dy}{dx}$. Simplify your answer as much as possible.

a) $y = x^2 \sin^3(2x)$

b) $y = x\cos(5x) - \sin^2 x$

c) $y = \left(x + \csc(x^3 + 3)\right)^{-3}$

d) $y = \left(\frac{5x}{3x+2}\right)^3$

4) [16 points] Find $f'(x)$. Simplify your answer as much as possible.

a) $f(x) = x^8 - 3\sqrt{x} + 5x^{-3}$

b) $f(x) = \dfrac{4x^2 - x + 3}{\sqrt{x}}$

c) $f(x) = \left(\dfrac{3x+2}{x}\right)\left(x^{-5} + 1\right)$

d) $f(x) = (3x-5)^4 (7-x)^{10}$

5) [4 points] Find $\frac{d^2y}{dx^2}$ for $y = x^5 \cos x$

6) [6 points] Show that $y = x \sin x$ is a solution to $y'' + y = 2\cos x$

7) [6 points] Find the x-coordinates of all points at which the graph of $f(x) = \frac{(x-2)}{x^3}$ has a horizontal tangent line.

8) [6 points] Find an equation for the tangent line to the graph of $y = \tan(4x^2)$ at $x = \sqrt{\pi}$

9) [6 points] Given that $f(2) = 1$, $f'(2) = 7$, and $g(2) = 1$, $g'(2) = -5$

a) Find $g'(2)$, where $g(x) = [f(x)]^3$

b) Find $h'(2)$, where $h(x) = \dfrac{f(x)}{g(x)}$