

Prince Sultan University
Department of Mathematical Sciences

Major II Exam

Semester I, 2005 / 2006 Fall (051)

28th November, 2005

MATH 111 – CALCULUS I

Time Allowed : 100 minutes

Maximum Points: 100 points

Mr. Khaled Naseralla

Name of the student : _____

ID number : _____

Section : _____

For All The Students:

- Answer all the questions.
- This exam consists of **a total of 7 pages and 10 questions.**
- Show your working in the space provided for each question.
- Show all the key steps of your work.
- Scientific, non-programmable calculators are allowed.

Question	Maximum score	Your Score
Q.1	15	
Q.2	8	
Q.3	28	
Q.4	6	
Q.5	7	
Q.6	6	
Q.7	12	
Q.8	6	
Q.9	6	
Q.10	6	
Total	100	

Q.1: Find the limits:

(15 points)

1) $\lim_{x \rightarrow 0} \frac{2 \sin \pi x}{\tan 4x}$

2) $\lim_{y \rightarrow 0} \frac{\tan 3y}{6y}$

3) $\lim_{x \rightarrow 0} \frac{7x^3 - 4\sin^2 3x}{x^2}$

Q.2: For $y = x^3 - 2$

(8 points)

a) Find the average rate of change of y with respect to x over the interval $[2, 3]$.

b) Find the instantaneous rate of change of y with respect to x at $x_0 = 2$

Q.3: Find $\frac{dy}{dx}$ for the following functions:

(28 points)

(simplify your answer as much as possible)

a) $y = (x^3 - 7x^2 + 4)(3x^2 + 14)$

b) $y = \cos\left(\frac{4x}{x^2 + 1}\right)$

c) $x^2 \tan y + y^5 \sec x = 2x$

d) $3xy^3 - 4x = 10y^2$

e) $y = \sqrt[3]{\sec x^2}$

f) $y = \left(\frac{2x + 4}{3x - 1} \right)^3$

g) $y = \frac{1}{x\sqrt{x^2+1}}$

Q.4: Determine the equation of the tangent line to the curve of the function (6 points)
at the given point.

$$x^2y^2 = 4y \quad \text{at } (2,1)$$

Q.5: Determine where the following function has horizontal or vertical tangent lines. (7 points)

$$xy - 2x^3 = 32$$

Q.6: Let f and g be functions such that $f(1) = -1$, $f'(1) = 2$, and $g'(-1) = -4$. (6 points)

Let $F(x) = (f(x))^2 - (g \circ f)(x)$

Find $F'(1)$.

Q.7: a) Find $y''(0)$ if $y = x \cos x + 4 \sin^2 x$ (12 points)

b) Find $\frac{d^2y}{dx^2}$ for $x^2 - y^4 = 10$

Q.8: Find $f'(x)$, $f''(x)$, and $f'''(x)$ if $f(x) = \frac{x-1}{x^2}$

(6 points)

Q.9: Use the definition of derivative to show that $f(x) = |x-2|$ is not differentiable at $x = 2$

(6 points)

Q.10: Find all the discontinuities of $f(x) = x^2 \tan x$

(6 points)