



Prince Sultan University
Department of Mathematical Sciences
Major I Exam
Semester II, SPRING (122)
6th April, 2013

MATH 111 – CALCULUS I

Time Allowed : 90 minutes

Maximum Points: 60 points

Name of the student: _____

ID number : _____

Dr. Younis Zaidan	Dr, Mohammad Siddique	Mr. Khaled Naseralla
Section 223	Section 224	Section 225
10 ---- 11	11 ----- 12	8 ----- 9

Important Instructions

- You may use a **SCIENTIFIC CALCULATOR** that does **NOT** have **GRAPHING** capabilities.
- You may **NOT** borrow a calculator from anyone.
- Answer **ALL** the questions.
- Show all the key steps of your work in the space provided for each question. Please indicate your **FINAL** answers clearly.
- You may use the **BACK** of the pages for extra space, but be sure to indicate that on the page with the problem.
- There should be **NO** talking during the exam.
- This exam has **10** problems, some with several parts. Make sure your paper has all these problems.

Question	Maximum Points	Points Earned
1 , 2 , 3	13	
4 , 5 , 6	14	
7 , 8 , 9	16	
10	17	
Total	60	

Q.1 (2 points): If the tangent line to $y = f(x)$ at $(1, 2)$ passes through the point $(3, -6)$, determine the values of $f(1)$ and $f'(1)$.

Q.2 (6 points): Use the limit definition of the derivative to find the derivative of $f(x) = \frac{1}{\sqrt{x}}$.

Q.3 (5 points): Find an equation of the tangent line to the curve $y = x\sqrt{x}$ that is parallel to the line $2y - 6x = 1$.

Q.4 (4 points):

Sketch a possible graph of a function f that satisfies all of the following conditions:

$$f(0) = 0, \quad f'(-1) = 0$$

$$\lim_{x \rightarrow \infty} f(x) = 0, \quad \lim_{x \rightarrow -\infty} f(x) = \infty$$

$$\lim_{x \rightarrow 1^-} f(x) = \infty, \quad \lim_{x \rightarrow 1^+} f(x) = -\infty$$

Q.5 (4 points):

Prove that $\lim_{x \rightarrow 0} \frac{\sin 6x}{\sin 4x} = \frac{3}{2}$. (Show all the steps).

Q.6 (6 points):

Find all possible values of c for which the function g is continuous at $x = 4$. Show all details.

$$g(x) = \begin{cases} x^2 - c^2 & \text{if } x < 4 \\ cx + 4 & \text{if } x > 4 \\ 12 & \text{if } x = 4 \end{cases}$$

Q.7 (6 points): Evaluate each of the following limits. (Show all the steps).

i.
$$\lim_{y \rightarrow -\infty} \frac{2 - 3y^2}{5y^2 + 4y}$$

ii.
$$\lim_{x \rightarrow \infty} \frac{2 - 3e^x}{1 + e^x}$$

Q.8 (5 points): Find the horizontal asymptotes of $f(x) = \frac{x+2}{\sqrt{9x^2+1}}$. (Show all the steps).

Q.9 (5 points): Discuss the differentiability of the function $f(x) = |x - 6|$. (Show all the steps).

Q.10 (17 points): Find the derivative of each function. Simplify your answer:

i. $y = (1 + 2x^2)^5 (3 + x - x^2)$

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

iii. $y = e^x \cos(2x)$

iv. $y = \sqrt[3]{1 + \tan x}$

v. $y = \cot^2(\cos x)$