Prince Sultan University
Department of Mathematical Sciences
Major I Exam
Semester II, SPRING (122)
4th May, 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

Question	Maximum Points	*Points Earned*
1 , 2	30	
3 , 4 , 5	15	
6 , 7 , 8	15	
Total	**60**	

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 **8** problems, some with several parts. Make sure your paper has all these problems.

Q.1 (24 points): Find $\dfrac{dy}{dx}$ of all of the following and write your answer in simplified form:

a) $y = \sqrt{1-x^2} \, \cos^{-1} x$

b) $y = \ln\left(x\sqrt{x^2-1}\right)$

c) $y = \ln\left(x^2 + y^2\right)$

d) $\tan^{-1}\left(x^2 y\right) = x + xy^2$

e) $y = \left(x^2 + 3\right)^{\ln x}$

f) $y = \cosh^2\left(1 + e^{2x}\right)$

g) $y = x \sinh^{-1}\left(\frac{x}{3}\right) - \sqrt{9 + x^2}$

Q.2 (6 points):   At noon, ship A is 100 km west of ship B. Ship A is sailing east at 35 km/h and ship B is sailing north at 25 km/h. How fast is the distance between the ships changing at 2:00 PM?

Q.3 (6 points): Find the absolute maximum and the absolute minimum values of $f(x) = x + \dfrac{1}{x}$ on the interval $[0.2, 4]$.

Q.4 (4 points): Prove the identity: $\tanh(\ln x) = \dfrac{x^2 - 1}{x^2 + 1}$.

Q.5 (5 points): Use the Mean Value Theorem to show that $|\cos a - \cos b| \le |a - b|$ for all a and b.

Q.6 (4 points): Find the critical numbers of $f(x) = x^{\frac{1}{3}} - x^{-\frac{2}{3}}$.

Q.7 (5 points): Find an equation of the tangent line to the curve $x^2 + 2xy - y^2 + x = 2$ at the point (1, 2).

Q.8 (6 points): Verify that the function $f(x) = \dfrac{x}{x+2}$ satisfies the hypotheses of the Mean Value Theorem on the interval $[1,4]$. Then find all numbers c that satisfy the conclusion of the Mean Value Theorem.