

Prince Sultan University
Department of Mathematical Sciences
Major I Exam

Semester II, 2014 SPRING (132)
10th March, 2014

MATH 111 – CALCULUS I

Time Allowed : 90 minutes

Maximum Points: 60 points

Name of the student: _____

ID number : _____

Dr. Nasreddine Megrez	Mr. Abed Zargar	Mr. Khaled Naseralla
Section 219	Section 218	Section 217
11 ----- 12	10 ----- 11	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 **13** problems, some with several parts. Make sure your paper has all these problems.

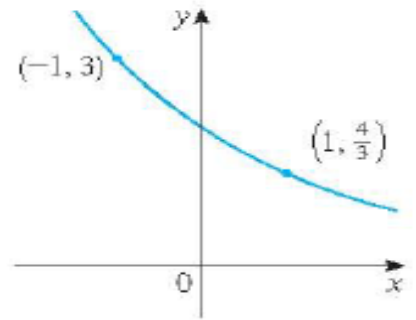
Question	Maximum Points	Points Earned
1 , 2 , 3	12	
4 , 5 , 6	15	
7 , 8 , 9	16	
10 , 11	26	
12 , 13	11	
Total	80	

Q.1 (4 points): Given that $f(x) = \frac{1}{x^2}$ find the Difference Quotient, $\frac{f(x+h) - f(x)}{h}$.

Q.2 (3 points): Find the Domain of $f(x) = \frac{3x-9}{\sqrt{x^2+x-6}}$

Q.3 (5 points): Write the following function in piecewise form, without absolute value bars $f(x) = |x+3| + 2|x-2|$.

Q.4 (4 points): Find an exponential function of the form $y = Ca^x$ using the given graph.



Q.5 (8 points): (i) Use transformations to sketch the graph of $f(x) = -\frac{1}{2}e^{(x-1)} + 3$. Show the location of the asymptote and the x or y intercepts, if any. (Without using a table of values)

(ii) State the domain and range of f .

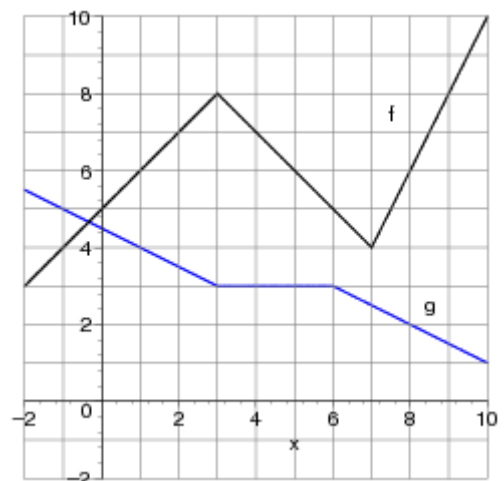
(iii) Find the inverse of f , and state its domain and range.

Q.6 (3 points): Use the graph below to find

(i) $f(g(3))$

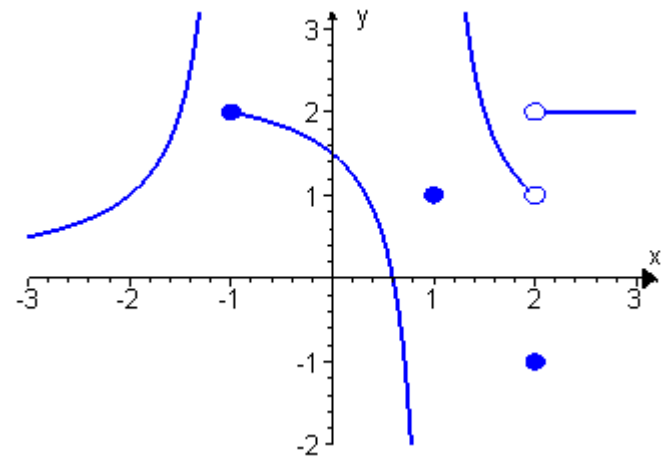
(ii) $(g \circ g)(6)$

(iii) $(f \circ f)(-1)$



Q.7 (4 points): Solve the equation $e^{3x+1} = 3e^{x-2}$

Q.8 (8 points): Use the following graph to answer the following questions



a) $\lim_{x \rightarrow -1^+} g(x) =$

b) $\lim_{x \rightarrow -1^-} g(x) =$

c) $\lim_{x \rightarrow -1} g(x) =$

d) $\lim_{x \rightarrow 1} f(x) =$

e) $\lim_{x \rightarrow 2^-} g(x) =$

f) $\lim_{x \rightarrow -\infty} g(x) =$

g) Where is f continuous only from the right?

h) Is f continuous at $x = 2$? Justify your answer.

Q.9 (4 points): Show that $\lim_{x \rightarrow \infty} \frac{1}{x^2} \sin(x) = 0$

Q.10 (22 points): Evaluate the limit, if it exists.

Show your detailed solutions

(i) $\lim_{x \rightarrow 3} \frac{x^2 - x - 6}{x - 3}$

(ii) $\lim_{y \rightarrow 0} \frac{2 - \sqrt{4 - y}}{y}$

(iii) $\lim_{x \rightarrow 2} \frac{x^2 + 1}{x - 2}$

(iv) $\lim_{x \rightarrow 3} \frac{x^2 - 9}{|x - 3|}$

(v) $\lim_{x \rightarrow \infty} \frac{x^3 - 3x + 1}{1 - 4x^3}$

(vi) $\lim_{x \rightarrow -\infty} \frac{1 - e^{-2x}}{1 + 2e^{-2x}}$

(vii) $\lim_{x \rightarrow \infty} (\sqrt{9x^2 + x} - 3x)$

Q.11 (4 points): Show that the equation: $x^3 - 15x = -1$ has a root in the interval $[3, 4]$

Q.12 (6 points): Determine all vertical and horizontal asymptotes (if any) for the following function.

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

Q.13 (5 points): Discuss the continuity of the following function. Find the value of k , if possible, that will make the function continuous everywhere.

$$f(x) = \begin{cases} ke^{3x} & x \geq -1 \\ x^3 + x + 1 & x < -1 \end{cases}$$