

Prince Sultan University
Department of Mathematical Sciences
Major II Exam

Semester II, 2012 SPRING (112)

5th May 2012

MATH 111 – CALCULUS I

Time Allowed : 90 minutes

Maximum Points: 80 points

Name of the student: _____

ID number : _____

Section : **221(Mr. Khaled) or 222(Dr. Hamdi)**

For All The Students:

- Answer all the questions.
- This exam consists of **a total of 6 pages and 7 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
1	20	
2 , 3 , 4	18	
5	20	
6	8	
7	14	
Total	80	

Q.1 (20 points): Find the derivative. **Simplify** as much as possible.

(i) $y = \left(\frac{2x-1}{3-5x} \right)^{2012}$

(ii) $y = 2 \sin^4(5x^3)$

(iii) $y = \sin^{-1}(\sqrt{x+1})$, $x \in (-1, 0)$

(iv) $y = e^{5x} \ln(2x^3 + 4x^2)$

(v) $y = (\tan(2x))^x$

Q.2 (6 points): Determine $\frac{dy}{dx}$, if $\sqrt{x+4y} = x^2y^3 + 1$.

Q.3 (6 points): Find $f^{(3)}(x)$ and evaluate $f^{(3)}(-1)$ where $f(x) = \left(\frac{1}{1-x}\right)^4$.

Q.4 (6 points): Show that the equation $2x^3 - 6x^2 + 10x = 14$ has **exactly one root**.

Q.5 (20 points): Evaluate the limits, if it exists.

(i) $\lim_{x \rightarrow \infty} \frac{\sqrt{x} - \ln(x)}{\sqrt{x}}$

(ii) $\lim_{x \rightarrow 0} \frac{1 - \cos(3x)}{(3x)^2}$

(iii) $\lim_{x \rightarrow 0^+} \left(\frac{1}{x} - \frac{1}{e^x - 1} \right)$

(iv) $\lim_{x \rightarrow \infty} \left(\frac{x-3}{x+2} \right)^{2x}$

Q.6 (8 points): Find the x -coordinate of the point (s) on the graph of $f(x) = \frac{5x^{\frac{1}{5}}}{2+x}$
where: (i) the tangent line is horizontal.
(ii) the tangent line is vertical.

Q.7 (14 points): For the function h given by: $h(x) = x^5 - 5x^2 + 1$

- (i) Find the intervals where the function is increasing and where it is decreasing.
- (ii) Use the 2nd derivative test to characterize the local extreme points, if any.
- (iii) Find the intervals where the function is concave up and where it is concave down.
- (iv) Determine inflection point(s), if any.
- (v) Find the absolute extrema for f on the interval $[-2,1]$.