Prince Sultan University
Department of Mathematics & General Seciences

MATH 111

Final Exam

Semester II, Term 172

Saturday, May 6th, 2018

Time Allowed: 3 hours

Student Name: _____

Student ID #: _____ Section #: _____

Teacher's Name: _____

Serial Class Number: _____

Important Instructions:

1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You may NOT use notes or any textbook.
4. There should be NO talking during the examination.
5. Your exam will be taken immediately if your mobile phone is seen or heard
6. Looking around or making an attempt to cheat will result in your exam being cancelled
7. This examination has 11 problems, some with several parts.

Problems	Max points	Student's Points
1,2,3,4	18	
5,6,7	22	
8,9,10	27	
11	13	
Total	**80**	**_____ = _____/40**

Q.1 (4 points) Let $(x) = \begin{cases} \ln(x-2) & if\ x > 2 \\ x^2 + 3x + 1 & if\ -3 < x \leq 2 \\ \sqrt{1-4x} & if\ x \leq -3 \end{cases}$. Find the values of x , if any, at which f is not continuous. **Show all your steps**

Q2 (5 points) Find the equation of the normal line to the curve of $y = x^2 \ln(3x^2 - 2)$ at $x = 1$.

Q.3 (5 points) Let $xy + e^y = e$. Find the second derivative y'' at the point $(0,1)$.

Q.4 **(**4 points) A cylinder tank with radius 10 m is being filled with water at a rate of 3.5 m^3/min. How fast is the height of the water increasing?

Q.5 **(**4 points) Let $f(x)=\dfrac{1}{3(2-x)}$, find $f''(-2)$.

Q.6 (5 points) Let $f(x)=\ln(1+x^3)$, find all inflection points (if any) for the function f.

Q.7 (13 points) Calculate y' **(Note: Do not simplify your answer)**

(a) (3 points) $y=\dfrac{1}{\sqrt[3]{x+\sqrt{x}}}$

(b) (3 points) $y=10^{\tan \pi x}+\cos^{-1} x$

(c) (3 points) $y=x\tanh^3\left(x^2-5x\right)$

(d) (4 points) $\tan(x-y)=y^2$

Q.8 (7 points) Let $G(x)=\dfrac{1+\sinh x}{1+\cosh x}$, find $G(0)+G'(0)$

Q.9 (12 points) Find the limit **Show your work in details**

(a) $\lim\limits_{x\to 0}\dfrac{\sin x}{3^x-1}$

(b) $\lim\limits_{x\to -\infty} x^2\cdot\ln\left(1+\dfrac{1}{x^2}\right)$

(c) $\lim\limits_{x\to\infty} x^{e^{-x}}$

Q.10 (8 points) Find the points on the line: $y=2x+5$ that is closest to the origin.

Q.11 (13 points) Let $f(x) = \tan^{-1}(e^x)$. **Show your work in details**

(a) (2 points) Find the domain of f and the *y*-intercept.

(b) (2 points) Determine the vertical and horizontal asymptotes, if any.

(c) (2 points) Find the critical numbers and the local maximum and/or local minimum points, if any.

(d) (4 points) Find the intervals on which f are concave up and/or concave down and the inflection point(s) if any.

(e) (3 points) Sketch the graph of f showing on the graph all significant features