Prince Sultan University

Math 113
Final Exam
Second Semester, Term 152
May 10, 2016

Time Allowed: 120 minutes

Student Name:_____ _____ _____

Student ID #: _____

Serial Class #:_____ Section #:

Circle your instructor's Name: 1. Dr. Aiman Mukheimer 2. Dr. Jamiiru Luttamaguzi

3. Prof. Wasfi Shatanawi

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. Talking during the examination is NOT allowed.
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 **9 Questions with 80 marks** and **one bonus Question (Q#10) with 4 marks**. Make sure your paper has all these problems.

Problems	Max marks	Student's marks
Q#1+Q#2	16	
Q#3+Q#4	16	
Q#5+Q#6	16	
Q#7	16	
Q#8	12	
Q#9	4	
Total	80	
Q#10 (Bonus Question)	4	

Q#1. [4+1+1 Marks] Let $f(x)=\int_{2}^{2x}\frac{1}{1+t^{10}}dt$. Find:

1. $f'(x)=$

2. $f'(1)=$

3. $f(1)=$

Q#2[4 Marks each] Evaluate the following integral if possible (Explain your answer):

1. $\int\frac{2e^{x}}{\sinh x+\cosh x}dx$

2. $\int_{0}^{1}x^{2}\sqrt{x+1}\,dx$

3. $\int_{-1}^{2}\frac{1}{x-1}dx$

Q#3[2+4+4 Marks] Let Ω denote to the region bounded by the curves $y = 4 - x^2$ and $y = 0$.

1. Sketch Ω [Show all intersection points with *x*-axis and *y*-axis].

2. Find the area of Ω.

3. Find the integral that represents the volume that is generated by rotating Ω about the line *y*=4.

Q#4 [6 Marks] Evaluate the integral $\int \frac{dx}{\sqrt{x^2 - 8x + 20}}$.

Q#5[6 Marks each] Evaluate

1. $\int \tan^{-1} x\,dx$

2. $\int \sec^4 x\sqrt{\tan x}\,dx$

Q#7[4 Marks] Find the exact area of the surface obtained by rotating $y = x^3, 0 \le x \le 2$ about the x-axis.

Q#7[4 Marks each] Determine the convergence of the following series:

1. $\sum_{n=1}^{+\infty} \sin\left(\frac{1}{n}\right)$

2. $\sum_{n=1}^{+\infty} \cos\left(\frac{1}{n}\right)$

3. $\sum_{n=1}^{+\infty} \frac{3^{2n+1}}{4^{n-1}}$

4. $\sum_{n=1}^{+\infty} \frac{(2n)!}{(n!)^2}$

Q#8[8+4 Marks] Find the radius and interval of convergence of the power series

1. $\sum_{n=1}^{+\infty} \frac{(x+2)^n}{n^2 3^n}$

2. $\sum_{n=1}^{+\infty} n^n (2x-8)^n$

Q#9[4 Marks] Determine whether the integral $\int_0^{+\infty} \frac{x^5}{\sqrt{1+x^3}}\,dx$ converges or diverges. If it converges find the value.

The next Question is a Bonus Question You may solve it or you may leave it. If you solve it, an extra 4 marks will be added to your total marks. Try to solve this Question after you finish the solution of all above Questions.

Q#10[4 Marks](Bonus Question) Let $s(x) = x^2 + \frac{1}{8}\ln x - \frac{2}{3}$ represents to the arc length function of a smooth curve *f* by taking $P_0(1,1)$ as the starting point. Find the formula of *f*.