

## **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 <u>9 Questions with 80 marks</u> and <u>one bonus Question (Q#10) with 4 marks</u>. 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):

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

$$2. \quad \int\limits_{0}^{1} x^2 \sqrt{x+1} \, dx$$

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

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

- 1. Sketch  $\Omega$  [Show all intersection points with *x*-axis and *y*-axis].
- 2. Find the area of  $\Omega$ .

3. Find the integral that represents the volume that is generated by rotating  $\Omega$  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. $\int \tan^{-1} x \, dx$

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

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

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

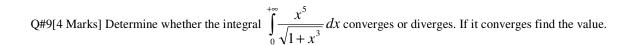
$$3. \quad \sum_{n=1}^{+\infty} \frac{3^{2n+1}}{4^{n-1}}$$

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

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



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.