Prince Sultan University
MATH 113
Final Examination
First Semester 2014/2015, Term 141
Saturday, 3rd January 2015
Dr. Bahhaeldin Abdalla & Dr. Ahmed Kaffel

Time Allowed: 120 minutes
Maximum points: 70 points

Name: _____   ID Number # _____

Important Instructions:

1. You may use CASIO scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You do NOT get special consideration if you forget your calculator.
4. Don't use notes or any notebook.
5. There should be NO talking during the examination.
6. Your exam will be taken immediately without any warning if your mobile is seen or heard.
7. You must show all your work beside the problem. Be organized.
8. You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.
9. This examination has *12* problems, some with several parts. Make sure that your paper has all these problems.

Problem	Max points	Student's Points
1	11	
2,3	12	
4,5,6,7	12	
8,9,10	13	
11	10	
12	12	
Total	*70*	

1. ((3+3+2+3) points) Evaluate each integral.

(a) $\int \left(\dfrac{1-x}{x} \right)^2 dx$

(b) $\int \dfrac{\tan^3 x}{\sec^3 x} dx$

(c) $\int\limits_0^b \dfrac{d}{dx} \left(e^{\arctan x} \right) dx$

(d) $\int \dfrac{dx}{\sqrt{e^x - 1}}$

2. (8 points) Evaluate each integral.

(a) $\int \dfrac{8x+6}{x^3+3x^2}dx$

(b) $\int \dfrac{x^2}{\left(4-x^2\right)^{3/2}}\,dx$

3. (4 points) Find the area of the surface obtained by rotating the curve
$y = \dfrac{x^4}{16} + \dfrac{1}{2x^2}$, $1 \le x \le 2$ about the y-axis.

4. (4 points) Evaluate $\displaystyle\int_{-2}^{1} \frac{1}{x^4}\,dx$ if possible.

5. (2 points) If $\displaystyle\int_{0}^{6} \frac{f(x)}{\pi}\,dx = 10$ and $\displaystyle\int_{0}^{4} f(x)\,dx = 7$, find $\displaystyle\int_{4}^{6} f(x)\,dx$.

6. (4 points) Find the average value of the function $f(x) = x\sec x \tan x$ on the interval $\left[0, \dfrac{\pi}{3}\right]$.

7. (2 points) Suppose $\displaystyle\sum a_n = 4$ and s_n is the nth partial sum of the series.
   (a) Find $\displaystyle\lim_{n\to\infty} a_n$

   (b) Find $\displaystyle\lim_{n\to\infty} s_n$

8. (5 points) Find the volume of the solid obtained by rotating the region bounded by $x = 5$ and $x = 9 - y^2$ about the line $x = -1$.

9. (3 points) Determine whether the sequence $a_n = \dfrac{\ln n}{\sqrt{n}}$ is convergent or divergent. **Justify your answer in details.**

10. (5 points) Determine whether the series $\displaystyle\sum_{n=1}^{\infty} (-1)^{n-1} \dfrac{\sqrt{n}}{n+1}$ is absolutely convergent, conditionally convergent or divergent. **Justify your answers in details.**

11. ((3+3+4) points) Determine whether the following series converges or diverges. **Justify your answers in details.**

(a) $\displaystyle\sum_{n=1}^{\infty} \frac{(-5)^{2n}}{n^2 9^n}$

(b) $\displaystyle\sum_{n=1}^{\infty} \left(\frac{5}{n^2} + \frac{2^n}{3^n} \right)$

(c) $\displaystyle\sum_{n=2}^{\infty} \frac{1}{n\sqrt{\ln n}}$

12. ((4+8) points) Find the radius of convergence and interval of convergence of the foolowing series.

(a) $\displaystyle\sum_{n=0}^{\infty} n^n (x-2)^n$

(b) $\displaystyle\sum_{n=1}^{\infty} \frac{(x+3)^n}{n5^n}$