Saint Mary's University
Department of Mathematics
and Computing Science

Name: _____

Signature: _____

ID: _____

Math 1211: Winter 2014
Midterm Test #2 — Version A

March 12, 2014

Recitation Section:

☐ Section A: 10:00–11:15F (J. Irving)
☐ Section B: 2:30–3:45W (J. Irving)
☐ Section C: 1:00–2:15F (A. Ellis)
☐ Section D: 1:00–2:15F (S. Sikka)
☐ Section E: 10:00–11:15F (S. Sikka)

Instructions:

- *No electronic devices or aids of any kind are to be in your immediate possession during the test. Possession of such items will be construed as an act of academic dishonesty.*
- *There are 5 pages plus this cover page. Check that your test paper is complete.*
- *There are a total of 70 marks. The value of each question is indicated in the margin.*
- *Answer in the spaces provided, using backs of pages for additional space if necessary.*
- *Show all your work. Insufficient justification will result in a loss of marks.*

Page	**Maximum**	**Your Score**
1	15	
2	13	
3	12	
4	18	
5	12	
Total	**70**	

1. Evaluate the following integrals.

[5] (a) $\displaystyle\int \tan^5 x \sec^4 x \, dx$

[10] (b) $\displaystyle\int \frac{dx}{x^3\sqrt{x^2-4}}\, dx$

[13] (c) $\displaystyle\int \frac{12x+2}{(x+1)^2(x^2+9)}\,dx$

[12] 2. Determine whether the following improper integrals converge or diverge. If an integral converges, find its value.

(a) $\displaystyle\int_e^{\infty} \frac{dx}{x(\ln x)^2}$

(b) $\displaystyle\int_{-1}^{2} \frac{3}{(2-t)^2}\,dt$

(c) $\displaystyle\int_0^{1} \frac{e^x}{1-x}\,dx$ [*Hint:* This is a challenge. Leave it until the end.]

[6] 3. Let $\mathcal{C}$ be the segment of the curve $y = \sin x$ between $x = 0$ and $x = \pi$.

(a) Give an expression, in terms of a definite integral, for the **length** of $\mathcal{C}$.

(b) Give an expression, in terms of a definite integral, for the **surface area** of the solid obtained by revolving $\mathcal{C}$ around the x-axis.

[12] 4. (a) Find the third degree Taylor polynomial $T_3(x)$ of the function $f(x) = x^{3/2}$ centred at $x = 1$.

(b) Give an estimate of the error $\left|(1.1)^{3/2} - T_3\,(1.1)\right|$. Justify your answer.

[2] 5. (a) Define the *N-th partial sum* of the series $\sum_{n=1}^{\infty} a_n$.

[2] (b) Define precisely what it means to write $\sum_{n=1}^{\infty} a_n = S$.

[8] (c) Do the following series converge or diverge? If a series converges, determine its value.

i. $\sum_{n=1}^{\infty} \frac{n}{n+2}$

ii. $\sum_{n=1}^{\infty} \frac{2}{n(n+2)}$ [*Hint:* $\frac{2}{n(n+2)} = \frac{1}{n} - \frac{1}{n+2}$]