Prince Sultan University

Math 113
Final Exam
First Semester, Term 121
Wednesday, January 9, 2013

Time Allowed: 135 minutes

Student Name: _____

Student ID #: _____

Section Number: _____

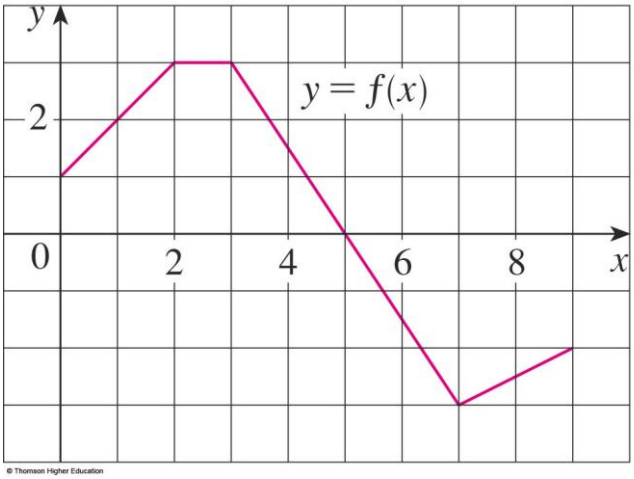
Instructor's Name: _____

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 13 problems, some with several parts. Make sure your paper has all these problems.

Problems	Max points	Student's Points
1, 2, 3	16	
4, 5	9	
6	15	
7, 8	15	
9, 10	10	
11	10	
12	15	
13	10	
Total	100	

1. (6 points) The graph of f is shown. Evaluate the following integrals:



a) $\int_0^5 f(x)dx$

b) $\int_5^7 f(x)dx$

c) $\int_0^9 f(x)dx$

2. (5 points) Let $g(x) = \int_{3x}^{x^3} \sqrt{t}\ \sin t\ dt$. Find $g'(x)$.

3. (5 points) Find the area enclosed by the curve $y = x^3 - x^2 - 2x$ and the x-axis.

4. (5 points) Find the volume of the solid that results when the region bounded by the curve $y = 4 - x^2$ and the *x*-axis is revolved about the line $x = 3$.

5. (4 points) Find the arc length of the curve $y = \sqrt{1 - x^2}$ between $x = -1$ and $x = 1$.

6. (15 points) Evaluate each of the following integrals:

a) $\int \frac{x+1}{\sqrt{3-2x-x^2}}\,dx$

b) $\int \cos(x)\cos(2x)\,dx$

c) $\int \frac{2}{\sqrt{x^2-6x}}\,dx$

7. (10 points) Evaluate each of the following integrals:

   a) $\int \left(\cos^4 x - \sin^4 x\right) dx$

   b) $\int \frac{1}{x\sqrt{x+1}}\, dx$

8. (5 points) Use Comparison Test to determine whether the integral converges or diverges:

$$\int_1^{\infty} \frac{3+2\sin x}{5x^2}\, dx$$

9. (5 points) Determine whether the integral converges or diverges. Find the value of integral if it converges:

$$\int_1^5 \frac{2}{\sqrt{5-x}}\,dx$$

10. (5 points) Determine whether the sequence $a_n = \{\ln n - \ln(3n+2)\}_{n=1}^{\infty}$ converges or diverges. If it converges, find its limit.

11. (10 points) Determine whether the following series absolutely convergent, conditionally convergent or divergent. **Justify your answers in details.**

a) $\sum_{k=1}^{\infty}(-1)^{k+1}\frac{k}{3^{k+1}}$

b) $\sum_{n=6}^{\infty}(-1)^{n+5}\frac{n}{(n+5)^2}$

12. (15 points) Determine whether the following series converges or diverges. **Justify your answers in details.**

a) $\sum_{n=1}^{\infty} \frac{5^n}{(11+\cos^2(2))^n}$

b) $\sum_{n=1}^{\infty} \frac{1}{3n+8}$

c) $\sum_{k=1}^{\infty} \frac{e^{1/k}+1}{k^3}$

13. (10 points) Find the interval of convergence and radius of convergence of the following power Series:

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