Prince Sultan University
Department of Mathematical Sciences

MATH 113
Final Examination
Semester II, Term 102
Thursday, June 9, 2011
Time Allowed: 150 minutes

Section 219
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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. There should be NO talking during the examination.
5. If your mobile phone is seen or heard, your exam will be taken immediately.
6. You must show all your work beside the problem. Be organized.
7. This examination has 8 questions plus a Bonus question.
   Make sure your paper has all these problems.

Calculus II (Math 113), Final Exam- Spring(102).

1. (10Pts) Determine dy/dx

(a) $y = (\sin x + 1)^{\sqrt{2x^2+1}}$ (b) $y = \dfrac{\int_{\pi/2}^{x} \sin(t)dt}{x}$ and evaluate it at $x = \pi/2$.

2. (5pts) Study the **convergence** of the following integral $\int_{-\infty}^{0} \dfrac{1}{(x-1)^3}dx$

3. (30pts) Evaluate the following integrals using the method of your choice [1].

(a) $\int_0^4 \dfrac{2x+3}{\sqrt{1+2x}}\,dx$, (b) $\int \dfrac{x-1}{x^2+x+1}dx$

(c) $\int x\cos^2(x)dx$, (d) $\int \dfrac{2}{x^3+4x}dx$

(e) $\int \dfrac{1}{\sin(x)+\cos(x)+1}dx$. [Hint. one may set $t = \tan(x/2)$].

(f) $\int \dfrac{\sin(2x)}{\sin^2(x)-2\sin(x)-8}\,dx$.

4. (15pts) **Evaluate each limit**

(a) $\lim\limits_{x\to 0^+} x\ln^2(x)$

(b) $\lim\limits_{x\to+\infty}\left(1-\dfrac{3}{x}\right)^{4x}$.

(c) Find the **error** in the limit computation

$$\lim_{x\to 1}\frac{x^3-x^2+x-1}{x^3-x^2} = \lim_{x\to 1}\frac{3x^2-2x+1}{3x^2-2x} = \lim_{x\to 1}\frac{6x-2}{6x-2} = 1,$$

and find the **correct limit.**

5. (10pts) **Setup** the integral(s) giving the total area of the region between the graphs $y = x^2 - 4$ and $y = 2 + x$ over the interval $[1,\ 4]$.

6. (10pts) **Setup** the integral giving the volume of the solid generated by revolving the region bounded by $y = 0$, $y = \sqrt{x-3}$, $x = 7$ about

(a) the line $x = -1$ by the **Washers method**,

(b) the line $y = 3$ by the **Cylindrical shell's method**.

7. (10pts) Solve the following **differential equation**

$$xy' - y = x^2, \quad y(1) = -1.$$

8. (10pts) Apply **Simpson's rule**. to approximate $\int_0^2 \dfrac{1}{1+x^3}\,dx$ using a regular partition with $n = 4$.

9. (**Bonus** - 4pts) : Evaluate : $\int (1+2x^2)e^{x^2}\,dx$, $\int \dfrac{x^2+1}{x^4-x^2+1}\,dx$.

1. $\cos(2x) = 2\cos^2(x) - 1 = 1 - 2\sin^2(x)$, $\sin(2x) = 2\sin(x)\cos(x)$.