RED
TIMED

Name_____

Student Number_____

Section Number_____

Instructor_____

Math 113 – Winter 2003 – Form G

Departmental Final Exam

Instructions:

- The time limit is 3 hours.
- Evening Sections: Be sure to encode your name and student ID number on the bubble sheet.
- Problems 1 through 7 are multiple choice questions. Circle the letter of the correct answer on this exam form. Also students in evening section must fill in the Testing Center bubble sheet.
- Write the solutions to problems 8 through 19 directly on the exam paper in the space provided.
- Work on scratch paper will not be graded.
- Please write neatly and show your work to receive full credit.
- Notes, books, and calculators are not allowed.

For administrative use only:

M.C.	/28
8	/6
9	/6
10	/6
11	/6
12	/6
13	/6
14	/6
15	/6
16	/6
17	/6
18	/6
19	/6
Total	/100

Math 113 – Winter 2003

Departmental Final Exam
(Form G)

Part I: Multiple Choice

Problems 1 through 7 are multiple choice. Each multiple choice problem is worth 4 points.

- **Evening Sections** — Your answers to the multiple choice questions must appear BOTH on this test paper and on the Testing Center bubble sheet. On this exam paper circle the letter of the best answer to each question. Also encode the corresponding bubble on the Testing Center bubble sheet. *Failure to record the answer in both places may result in loss of points.* Ambiguous responses will receive no credit.
- **Daytime Sections** — Circle the letter of the best answer. Ambiguous responses will receive no credit.

1. In the decomposition of $\dfrac{5x+6}{(x-2)(x-4)(x-5)}$ as $\dfrac{A}{x-2}+\dfrac{B}{x-4}+\dfrac{C}{x-5}$, the value of A is

   (a) $-8/3$ (b) $31/3$ (c) 13 (d) -13

   (e) -8 (f) $8/3$ (g) 8 (h) $-31/3$

   (i) answer not given

2. Find an equation for the parabola with focus $F : (0, 1)$ and directrix $d : y = -1$

   (a) $y = x^2$ (b) $y = \frac{1}{4}x^2$ (c) $y = 4x^2$ (d) $x = y^2$

   (e) $y = -\frac{1}{4}x^2$ (f) $y = -4x^2$ (g) $x = \frac{1}{4}y^2$ (h) $x = 4y^2$

   (i) $x = -\frac{1}{4}y^2$ (j) $x = -4y^2$

3. The interval of convergence of the power series

$$\sum_{n=2}^{\infty} \frac{(x+2)^n}{\ln n}$$

   is

   (a) $[-1, 1]$ (b) $[-1, 1)$ (c) $(-2, 0)$ (d) (-4,-2)

   (e) $[1, 4)$ (f) $(-3, -1)$ (g) $[-3, -1)$ (h) $[-4, 0)$

   (i) $(-\infty, \infty)$ (j) $(1, 3)$

4. The Maclaurin series for the function $f(x) = 1 - \cos(3x^2)$ is

   (a) $1 - \frac{3x^2}{2!} + \frac{3x^4}{4!} - \frac{3x^6}{6!} + \cdots$ (b) $3^2x^4 + 3^3x^6 + 3^4x^8 + \cdots$

   (c) $1 - 3x + \frac{3^2x^2}{2} - \frac{3^3x^3}{3} + \cdots$ (d) $\frac{3^2x^4}{2!} - \frac{3^4x^8}{4!} + \frac{3^6x^{12}}{6!} - \cdots$

   (e) $-3x^2 + \frac{3^2x^4}{3!} - \frac{3^3x^6}{5!} + \cdots$ (f) $1 - \frac{3x^2}{3!} + \frac{3^2x^4}{6!} - \frac{3^3x^6}{9!} + \cdots$

   (g) $-x^3 + \frac{x^9}{3!} - \frac{x^{15}}{5!} + \frac{x^{21}}{7!} - \cdots$ (h) $1 - 2x^3 + \frac{2^2x^6}{2!} - \frac{2^3x^9}{3!} + \cdots$

   (i) $1 - \frac{x^6}{2!} + \frac{x^{12}}{4!} - \frac{x^{18}}{6!} + \cdots$

5. Find the area between $y = \cos 3x$ and $y = \sin 3x$ over $[0, \frac{\pi}{12}]$.

   (a) $\frac{1}{4}\sqrt{2} - \frac{1}{4}$ (b) $\frac{1}{2}\sqrt{2} - \frac{1}{2}$ (c) $\frac{1}{3}\sqrt{2} - \frac{1}{3}$

   (d) $-\frac{1}{3}\sqrt{2} + \frac{1}{3}$ (e) $\frac{1}{2} - \frac{1}{2}\sqrt{2}$ (f) $\frac{1}{4} - \frac{\sqrt{2}}{4}$

6. The base of a solid is the circular region $x^2 + y^2 \leq 4$. A cross section perpendicular to the y axis is a square. Find its volume.

   (a) $\frac{128}{3}$ (b) 144 (c) 72 (d) 128 (e) 256 (f) 32

7. The polar equation $r = 4\cos\theta$ represents a

   (a) spiral of Archimedes (b) cardioid

   (c) circle of radius 4 (d) circle of radius 2

   (e) lemniscate (f) wizard of Weierstrass

   (g) tornado of Torricelli (h) lynn of Garner

Note: If you are taking this exam in the Testing Center, you should have circled the correct responses on the exam paper **and** you should have filled in the corresponding bubbles on the bubble sheet.

Part II: Written Solutions

Problems 8 - 19: Give the best answer and *justify* it with suitable reasons and/or relevant work.

8. Determine the Taylor polynomial of degree 3 centered at $c = 1$ for the function $f(x) = 1 + x + x^3 + x^7$.

9. Find the sum of the series

$$\sum_{n=0}^{\infty} n(n-1)x^{n-2}$$

and determine its interval of convergence.

10. Use a series to approximate $\sqrt{17}$ correct to within 10^{-4}. You should use the *minimum* possible number of terms in the series approximation to achieve the desired accuracy.

11. Evaluate the integral $\displaystyle\int \frac{1+\sin x}{\cos x}\,dx$

12. Let

$$C : \begin{cases} x = \cos(\ln t) \\ y = \sin(\ln t) \end{cases} \qquad t \in [1, e^2]$$

be a curve given in parametric form. Determine the length of the curve C.

13. Find the area enclosed by the polar curve $r = 2 - \cos\theta$.

14. Evaluate the integral

$$\int \frac{dx}{x^2\sqrt{x^2-25}}$$

15. Evaluate the integral

$$\int \ln(1+x^2)\,dx$$

16. Tell whether $\int_0^3 \frac{dx}{(3-x)^2}$ converges, and give its value if it does converge.

17. Tell whether $\int_0^\infty xe^{-2x}dx$ converges, and give its value if it does converge.

18. The pressure of water at a depth of y feet is $62.5\,y$ pounds per square foot. A dam is 12 feet high and 50 feet wide. The water level is at the top of the dam. Write an integral for the total force on the dam. You are not required to evaluate the integral.

19. Find the volume of the solid obtained by rotating the region

$$\left\{(x, y) \mid -2 \leq x \leq 2,\, 0 \leq y \leq 4 - x^2\right\}$$

about the line $x = -3$.