Name: ____________________________

Instructor: ________________________

Math 10560, Exam 3.
April 22, 2008

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- No calculators.
- The exam lasts for 1 hour and 15 min.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 10 pages of the test.

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1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)
7.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)

Please do NOT write in this box.

Multiple Choice	______
10.	______
11.	______
12.	______
13.	______
Total	______

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Multiple Choice

1.(6 pts.) Compute the following limit:

$$\lim_{n\to\infty} \frac{\sin n}{n^2}$$

(a) ∞ (b) 1 (c) 0

(d) $\sin n$ (e) Does not exist

2.(6 pts.) Compute the following limit:

$$\lim_{n\to\infty} \frac{3n^2(n-2)!}{n!}$$

(a) 0 (b) 1 (c) ∞

(d) 3 (e) $-\infty$

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3.(6 pts.) Does the series $\sum_{n=0}^{\infty} \frac{3+2^n}{\pi^{n+1}}$ converge or diverge? If it converges, compute its value.

(a) converges to $\frac{1}{\pi-3} + \frac{1}{\pi-2}$

(b) converges to $\frac{3}{1-\pi} + \frac{2}{2-\pi}$

(c) converges to $\frac{3\pi}{\pi-1} + \frac{\pi}{\pi-2}$

(d) diverges

(e) converges to $\frac{3}{\pi-1} + \frac{1}{\pi-2}$

4.(6 pts.) Which of the following statements are true about the series $\sum_{n=1}^{\infty} \frac{n^2+1}{n^5 - n^2\sqrt{3}}$?

I. This series converges because $\lim_{n\to\infty} \frac{n^2+1}{n^5-n^2\sqrt{3}} = 0$.

II. This series converges by Ratio Test.

III. This series converges by Limit Comparison Test against the p-series $\sum_{n=1}^{\infty} \frac{1}{n^3}$.

(a) II, III only

(b) I, II only

(c) III only

(d) None

(e) I, III only

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5.(6 pts.) One of the statements below holds for the series $\sum_{n=1}^{\infty} \frac{\cos(2n)}{n^2+1}$. Which one?

(a) This series diverges by Ratio Test.

(b) This series is conditionally convergent.

(c) This series converges by Alternating Series Test.

(d) This series is absolutely convergent by Comparison Test.

(e) This series diverges because $\lim_{n\to\infty} \frac{\cos(2n)}{n^2+1}$ is not 0.

6.(6 pts.) Which of the following statements are true about the series $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n^2}$?

I. This series converges by the Alternating Series Test.
II. This series converges by the Ratio Test.
III. This series converges absolutely.

(a) I, III only (b) I, II only (c) I, II, III

(d) II, III only (e) None

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7.(6 pts.) Compute the radius of convergence of the power series $\sum_{n=1}^{\infty} 2^n (x-1)^{2n}$.

(a) $R = \dfrac{1}{2}$ (b) $R = 2$ (c) $R = \infty$

(d) $R = \dfrac{\sqrt{2}}{2}$ (e) $R = 0$

8.(6 pts.) Identify the Taylor Series of $f(x) = \sin(x)$ centered at $a = \dfrac{\pi}{2}$, and its interval of convergence.

(a) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n x^{2n}}{(2n)!}, \quad I = [-1, 1)$

(b) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n (x-\pi/2)^{2n}}{(2n)!}, \quad I = (-\infty, \infty)$

(c) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n (x-\pi/2)^{2n+1}}{(2n+1)!}, \quad I = (-\infty, \infty)$

(d) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n (x+\pi/2)^{2n}}{(2n)!}, \quad I = \left[\frac{\pi}{2} - 1, \frac{\pi}{2} + 1\right)$

(e) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n (x-\pi/2)^{2n+1}}{2n+1}, \quad I = \left[\frac{\pi}{2} - 1, \frac{\pi}{2} + 1\right)$

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9.(6 pts.) The following is the fourth order Taylor polynomial of the function $f(x)$ at a.

$$T_4(x) = 10 + 5(x-a) + \sqrt{3}(x-a)^2 + \frac{1}{2\pi}(x-a)^3 + 17e(x-a)^4$$

What is $f'''(a)$?

(a) $\frac{1}{2\pi}$ (b) $2\sqrt{3}$ (c) $\frac{3}{\pi}$ (d) $\frac{1}{6\pi}$ (e) $17e$

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Partial Credit

You must show your work on the partial credit problems to receive credit!

10. (10 pts.) a) (5 pts) Give a power series representation for e^{x^2}.

b) (5 pts) Find the limit

$$\lim_{x \to 0} \frac{e^{x^2} - 1 - x^2}{x^4}.$$

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11. (12 pts.) Consider the function $f(x) = \dfrac{1}{2-3x}$.

a) (4 pts.) Find the Taylor series of $f(x)$ centered at 0.

b) (3 pts.) Determine the radius of convergence of this power series.

c) (4 pts) Find a power series representation for $\dfrac{1}{(2-3x)^2}$ and give its radius of convergence.

d) (1pt) What is the value of the series you found in part (c) at $x = 1/2$?

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12. (12 pts.) Find the interval of convergence of the following power series:

$$\sum_{n=1}^{\infty} \frac{(x+1)^n}{n}$$

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13. (12 pts.) Use the Integral Test to determine whether the series

$$\sum_{n=2}^{\infty} \frac{\ln(n)}{n^3}$$

is divergent or convergent. You must show that the Integral Test can be used in this situation.

`Note:` A correct answer with no work is worth only 3 points.

`Hint:` Use Integration By Parts.

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