Name: _____

Math 10360, Final Exam. Instructor: _____
December 15, 2007.

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- Be sure that you have all 14 pages of the test.
- No calculators are to be used.
- The exam lasts for 2 hours.
- This exam is conducted under the Honor Code.

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12.	(a)	(b)	(c)	(d)	(e)						
13.	(a)	(b)	(c)	(d)	(e)						
14.	(a)	(b)	(c)	(d)	(e)						

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Multiple Choice

1.(5 pts.) The solution of the equation $\ln(4x-3)=2$ is

(a) $x=\dfrac{e^3+4}{2}$ (b) $x=\dfrac{e^2+4}{3}$ (c) $x=\dfrac{e^2+3}{4}$

(d) $x=\dfrac{e^3+2}{4}$ (e) $x=\dfrac{e^4+3}{2}$

2.(5 pts.) If $f(x)=e^x\cos x$ which of the following is equal to the second derivative $f''(x)$ of $f(x)$?

(a) $2e^x\sin x$ (b) $e^x\sin x+e^x\cos x$ (c) $-2e^x\sin x$

(d) $-2e^x\cos x$ (e) $2e^x\cos x$

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3.(5 pts.) The integral

$$\int e^{\tan x} \sec^2 x \, dx$$

is equal to

(a) $e^{\sec x} + C$ (b) $e^{|\sec x + \tan x|} + C$ (c) $e^{\tan x} \sec x + C$

(d) $e^{\tan x} + C$ (e) $e^{-\ln|\sec x|} + C$

4.(5 pts.) Let $f(x) = \dfrac{1}{4x+3}$ for $x > 0$? Which of the following is the inverse function $f^{-1}(x)$ of $f(x)$?

(a) $\dfrac{3-3x}{x}$ (b) $\dfrac{1-3x}{4x}$ (c) $\dfrac{1}{4}x - 3$

(d) $4x + 3$ (e) $\dfrac{4x}{1-3x}$

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5.(5 pts.) A colony of bacteria grows at a rate proportional to the population at any given time. After 3 hours there are 400 bacteria, and after 5 hours there are 1600 bacteria. How many bacteria were there initially?

(a) $400e^{-3}$ (b) 100

(c) 50 (d) $\ln 100$

(e) 25

6.(5 pts.) Which of the following is the equation of the tangent line to the curve

$$\ln(y)\ln(x) = 2$$

at the point where $x = e$?

(a) $2ex + y = e^2$ (b) $y = ex$ (c) $x + y = e^2 + e$

(d) $2ex + y = 3e^2$ (e) $2ex - y = e^2$

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7.(5 pts.) Evaluate

$$\int_0^{\frac{\pi}{2}} \frac{\cos x}{1+\sin^2 x}\, dx.$$

(a) $-\frac{\pi}{2}$ (b) $\frac{\pi}{4}$ (c) $-\frac{\pi}{4}$ (d) $\frac{\pi}{2}$ (e) 0

8.(5 pts.) Which of the following is the general solution of the differential equation

$$y' + y = x^2 \ ?$$

(a) $y = Ce^{-x}$

(b) $y = x^2 - Cx + 2 + e^x$

(c) $y = x^2 - 4x + 2 + 3e^{-x}$

(d) $y = x^2 - 2x + 2 + Ce^{-x}$

(e) $y = x^2 + e^{-x}$

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9.(5 pts.) Compute the indefinite integral

$$\int e^x \sin(x) dx$$

(a) $\dfrac{e^x \sin(x) - e^x \cos(x)}{2} + C$

(b) $e^x \cos(x) + e^x \sin(x) + C$

(c) $\dfrac{e^x \cos(x) + e^x \sin(x)}{2} + C$

(d) $e^x \cos(x) + C$

(e) $-e^x \cos(x) + C$

10.(5 pts.) The series $\displaystyle\sum_{n=1}^{\infty} \frac{3^n}{7^n}$ is

(a) Convergent and we cannot find the sum

(b) Convergent and the sum is $\dfrac{7}{4}$

(c) Convergent and the sum is $\dfrac{7}{3}$

(d) Convergent and the sum is $\dfrac{3}{4}$

(e) Divergent

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11.(5 pts.) The sequence $\{a_n\} = \dfrac{2n^2+3n+1}{n(n+1)} + \dfrac{\pi}{n}$

(a) Converges to 2

(b) Converges to 1

(c) Diverges

(d) Converges to $1+\pi$

(e) Converges to $2+\pi$

12.(5 pts.) The series $\displaystyle\sum_{n=1}^{\infty} \frac{\sqrt{6n^4+3n^3+2n^2+6}}{n^4+3}$ is

(a) Divergent by the n'th term test for divergence

(b) Convergent by comparison with $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^4}$

(c) Divergent by comparison with $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^2}$

(d) Convergent by comparison with $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^2}$

(e) Convergent because $\displaystyle\lim_{n\to\infty} \frac{\sqrt{6n^4+3n^3+2n^2+6}}{n^4+3} = 0$

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13.(5 pts.) Find the following limit:

$$\lim_{x\to 0^+} \frac{xe^x}{\sin(x)}$$

(a) e (b) ∞

(c) 0 (d) 1

(e) -1

14.(5 pts.) Compute the integral:

$$\int \frac{2x-14}{(x-3)(x+1)}dx$$

(a) $5\ln|x+1| - 3\ln|x-3| + C$

(b) $4\ln|x+1| - 2\ln|x-3| + C$

(c) $4\ln|x-3| - 2\ln|x+1| + C$

(d) $2\ln|x-3| - 4\ln|x+1| + C$

(e) $3\ln|x-3| - 5\ln|x+1| + C$

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15.(5 pts.) The series

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

(a) Converges conditionally by the alternating series test

(b) Converges absolutely by the ratio test

(c) Diverges by the ratio test

(d) Diverges by the n'th term test for divergence

(e) Diverges by comparison to $\displaystyle\sum_{n=1}^{\infty} 5^n$

16.(5 pts.) The series $3 + \dfrac{6}{2} + \dfrac{9}{6} + \dfrac{12}{24} + \dfrac{15}{120} + \cdots$ has closed form

(a) $\displaystyle\sum_{n=1}^{\infty} \frac{3n}{n!}$

(b) $\displaystyle\sum_{n=1}^{\infty} \frac{3n}{(n+1)!}$

(c) $\displaystyle\sum_{n=0}^{\infty} \frac{3n}{n!}$

(d) $\displaystyle\sum_{n=1}^{\infty} \frac{3^n}{n!}$

(e) $\displaystyle\sum_{n=1}^{\infty} \frac{3(n+1)}{(n+1)!}$

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17.(5 pts.) What is the volume of the solid obtained by rotating the region between the graphs of $y = x^2$, $y = 0$ and $x = 1$ about the y-axis?

(a) 2π (b) π (c) 1 (d) $\frac{\pi}{2}$ (e) $\frac{\pi}{4}$

18.(5 pts.) Find the arclength of the curve $y = \frac{1}{3}(x^2 + 2)^{3/2}$ for $1 \leq x \leq 3$.

(a) $\frac{32}{3}$ (b) $\frac{15}{2}$

(c) $\frac{22}{3}$ (d) 5

(e) 11

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19.(5 pts.) A force of 16 pounds is needed to compress a spring 4 in from its natural length of 20 in. Find the work done in compressing the spring an additional 2 in.

(a) $64\ lb \cdot in$ (b) $40\ lb \cdot in$ (c) $20\ lb \cdot in$

(d) $72\ lb \cdot in$ (e) $32\ lb \cdot in$

20.(5 pts.) What is the area between the graphs of the curves $y = x^2 - 4x + 1$ and $y = -x + 1$?

(a) $\frac{9}{2}$ (b) 12 (c) 9 (d) $\frac{\sqrt{13}}{2}$ (e) 6

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21.(5 pts.) Use the Disk Method to determine what is the correct expression that computes the volume of the solid obtained by rotating the region between the curves $y = 2-x^2$ and $y = 1$ about the x-axis.

(a) $2\pi \int_{-1}^{1}(x(2-x^2))dx$ (b) $\int_{0}^{1}((2-x^2)^2-1)dx$ (c) $\pi \int_{-1}^{0}(1-x(2-x^2)^2)dx$

(d) $2\pi \int_{0}^{1}((1-x^2)^2)dx$ (e) $\pi \int_{-1}^{1}((2-x^2)^2-1)dx$

22.(5 pts.) The solution of the differential equation $(x+1)y = -y'$ with initial condition $y(0) = 1$ is:

(a) $y(x) = e^{x^2+x}$ (b) $y(x) = 1$

(c) $y(x) = e^{-x^2+1} - e + 1$ (d) $y(x) = e^{-x-x^2/2}$

(e) $y(x) = -e^{x^2} + 2e^{x}$

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23.(5 pts.) The 3th Taylor polynomial centered at $c = 1$ of $f(x) = \ln x$ is:

(a) $(x-1) - \frac{1}{2}(x-1)^2 + \frac{1}{6}(x-1)^3$

(b) $\ln x^3$

(c) $(x-1) + \frac{1}{2}(x-1)^2 + \frac{1}{3}(x-1)^3$

(d) $(x-1) - \frac{1}{2}(x-1)^2 + \frac{1}{3}(x-1)^3$

(e) $(x-3) - \frac{1}{2}(x-3)^2 + \frac{1}{3}(x-3)^3$

24.(5 pts.) The interval of the convergence of the power series $\sum_{n=0}^{\infty} \frac{(2x)^n}{n!}$ is:

(a) $-\infty < x < 0$ (b) $0 \leq x < \infty$ (c) all x

(d) $-1 < x < 1$ (e) $x = 0$

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25.(5 pts.) The power series for the function $f(x) = \dfrac{3}{x+2}$ centered at $c = 0$ is:

(a) $\displaystyle\sum_{n=0}^{\infty} \frac{3}{2}\left(-\frac{x}{2}\right)^n$ (b) $\displaystyle\sum_{n=0}^{\infty} \frac{3}{2}\left(-\frac{x}{2}\right)^{2n}$ (c) $\displaystyle\sum_{n=0}^{\infty} \frac{1}{2}\left(-\frac{x}{2}\right)^n$

(d) $\displaystyle\sum_{n=0}^{\infty} \frac{2}{3}\left(-\frac{x}{2}\right)^n$ (e) $\displaystyle\sum_{n=0}^{\infty} \frac{3}{2}\left(\frac{x}{2}\right)^n$

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