1.(6 pts.) Let $f(x) = x^7 - x^3 + 2x$. Find $(f^{-1})'(-2)$.

(a) $1/6$ (b) $1/4$ (c) 4 (d) 1 (e) 6

2.(6 pts.) Solve the following equation for x.

$$7^x 5^x = 9e^2 \ .$$

(a) $x = \dfrac{\ln 9 + 2}{\ln 12}$ (b) $x = \dfrac{2}{\ln 35}$ (c) $x = \dfrac{\ln 9 + 2}{\ln 35}$

(d) $x = \dfrac{2 \ln 7}{\ln 35}$ (e) There is no solution.

3.(6 pts.) Find the derivative of

$$y = x \cdot x^{1/x} \ .$$

(a) $x^{1/x} + x^{\frac{1}{x}-1}(1 - \ln x)$

(b) $x \cdot x^{\frac{1}{x}-3} = x^{\frac{1}{x}-2}$

(c) $x^{-1} \ln x(1 - \ln x)$

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

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

4.(6 pts.) Evaluate the following limit.

$$\lim_{x \to \infty} x \cdot x^{1/x} \ .$$

Remark: Note the function is the same in both problems 3 and 4.

(a) 0 (b) e^{-1} (c) ∞ (d) e (e) 1

5.(6 pts.) Find $f'(x)$ for

$$f(x) = \ln(2^x + x) + \arctan(e^x)$$

(a) $\dfrac{2^x + 1}{2^x + x} + \dfrac{1}{\sqrt{1 - e^{2x}}}$

(b) $\dfrac{2^x \ln 2}{2^x + x} + \dfrac{e^x}{1 + e^{2x}}$

(c) $\dfrac{e^x \ln 2}{2^x + x} + \dfrac{e^x}{\sqrt{1 - 2e^x}}$

(d) $\dfrac{2^x \ln 2 + 1}{2^x + x} + \dfrac{e^x}{1 + e^{2x}}$

(e) $\dfrac{e^x \ln 2 + 1}{2^x + x} + \dfrac{e^x}{\sqrt{e^{2x} - 1}}$

6.(6 pts.) Which line below is the tangent line to the polar curve $r = 1 + \cos\theta$ at the point where $\theta = \dfrac{\pi}{2}$?

(a) $y = x + 1$

(b) $y = \dfrac{1 - \sin\theta}{1 + \cos\theta}\,(x + 1)$

(c) $x = 0$, a vertical tangent

(d) $y = \dfrac{\pi}{2}x + \dfrac{\pi}{2}$

(e) $y = 1$, a horizontal tangent

7.(6 pts.) Evaluate the following definite integral.

$$\int_1^e \frac{\ln x}{x^3} dx \ .$$

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

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

8.(6 pts.) Evaluate

$$\int \frac{x^2}{\sqrt{9-x^2}}\, dx.$$

(a) $\frac{1}{2}x\sqrt{9-x^2}+C$ (b) $\frac{9}{2}\left[\arcsin(x/3)-\frac{x}{3}\right]+C$

(c) $\frac{9}{2}\left[\arcsin(x/3)-\frac{x\sqrt{9-x^2}}{9}\right]+C$ (d) $\frac{9}{2}\left[\arcsin(x/3)-\frac{x^2}{9}\right]+C$

(e) $9\arcsin(x/3)+C$

9.(6 pts.) Evaluate

$$\int \frac{x+7}{x^2+2x-3}\,dx.$$

(a) $\ln\left|x^2+2x-3\right|+C$

(b) $\ln\left|\dfrac{2(x+3)}{x-1}\right|+C$

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

(d) $\ln\left|\dfrac{(x-1)^2}{x+3}\right|+C$

(e) $\ln\left|\dfrac{(x+3)^2}{x-1}\right|+C$

10.(6 pts.) Find the Midpoint Rule approximation (using four intervals) of

$$\int_{-1}^{3} x^2\,dx\ .$$

(a) 11 (b) $\dfrac{28}{3}$ (c) $\dfrac{45}{4}$ (d) 9 (e) $\dfrac{35}{4}$

11.(6 pts.) Find the arclength of $y = 6 - 2x^{3/2}$, for $0 \leq x \leq 2$?

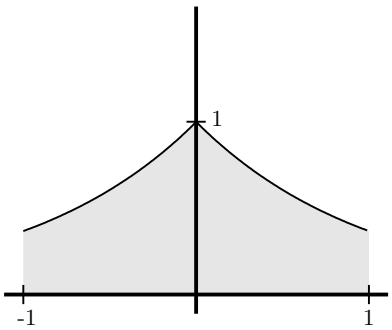
(a) $\frac{1}{9}[\sqrt{19} - 1]$ (b) $\frac{2}{3}[19\sqrt{19}]$ (c) $\frac{20}{3}\sqrt{10}$

(d) $\frac{2}{27}[10\sqrt{10} - 1]$ (e) $\frac{2}{27}[19\sqrt{19} - 1]$

12.(6 pts.) Find the center of mass of a plate with shape bounded below by the x–axis, on the left by $x = -1$, on the right by $x = 1$, and above by the curve

$$y = \begin{cases} 2^x & -1 \leq x \leq 0 \\ 2^{-x} & 0 \leq x \leq 1 \ . \end{cases}$$

The area is $\frac{1}{\ln 2}$.



(a) $\left(0, \frac{3 - \ln 2}{5 + 2\ln 2}\right)$ (b) $\left(0, \frac{3}{8\ln 2}\right)$ (c) $\left(0, \frac{2 + \ln 2}{8}\right)$

(d) $\left(0, \frac{1}{4}\right)$ (e) $\left(0, \frac{3}{8}\right)$

13.(6 pts.) Solve the initial value problem:

$$y' = (5 - 2x)(1 + y) \qquad y(1) = 0.$$

(a) $y(x) = e^{x^2-5x} - e^{-2}$ (b) $y(x) = e^{-4+5x-x^2} - 1$ (c) $y(x) = e^{5x-x^2} - e^4$

(d) $y(x) = e^{-4+5x-x^2}$ (e) $y(x) = e^{-3+5x-x^2} - e$

14.(6 pts.) If 50 grams of radioactive material with a half–life of two days are present at day zero, how many grams are left at day five?

(a) $\dfrac{50}{\sqrt{32}}$ (b) $\dfrac{50}{\sqrt{8}}$ (c) $\dfrac{50}{32^{1/3}}$ (d) $\dfrac{50}{4^{1/3}}$ (e) $\dfrac{50}{10}$

15.(6 pts.) If the function $y(x)$ satisfies the differential equation

$$xy' - 2y = x - 2$$

subject to the initial value $y(1) = 1$, what is $y(3)$?

(a) 3 (b) 4 (c) 7 (d) 5 (e) 6

16.(6 pts.) Which integral below computes the length of the parameterized curve $x(t) = t^3 - t$ and $y(t) = t^5 + t$ for $0 \leq t \leq 1$.

(a) $\displaystyle\int_0^1 (t^3 - t)\sqrt{2 - 6t^2 + 19t^4 + 25t^8}\ dt$ (b) $\displaystyle\int_0^1 (t^5 + t)\sqrt{t^3 + t^5}\ dt$

(c) $\displaystyle\int_0^1 \sqrt{t^3 + t^5}\ dt$ (d) $\displaystyle\int_0^1 \sqrt{2 - 6t^2 + 19t^4 + 25t^8}\ dt$

(e) $\displaystyle\int_0^1 (t^5 + t)(3t^2 - 1)\ dt$

17.(6 pts.) Which integral below gives the area inside the polar curve $r = \cos(3\theta)$?

(a) $\frac{1}{2}\int_0^{\pi} \cos^2(3\theta)\, d\theta$

(b) $\frac{1}{2}\int_{\pi/6}^{\pi/3} \cos^2(3\theta)\, d\theta$

(c) $\frac{1}{2}\int_0^{\pi} \sqrt{\cos^2(3\theta) + 9\sin^2(3\theta)}\, d\theta$

(d) $\frac{1}{2}\int_0^{2\pi} \cos^2(3\theta)\, d\theta$

(e) $\frac{1}{2}\int_0^{2\pi} \sqrt{\cos^2(3\theta) + 9\sin^2(3\theta)}\, d\theta$

18.(6 pts.) Which statement below is true about the series $\sum_{n=1}^{\infty} \frac{3^n}{n^3 + 2\cdot 3^n}$

(a) $\lim_{n\to\infty} \frac{3^n}{n^3 + 2\cdot 3^n} = 0$ so the series converges.

(b) $\lim_{n\to\infty} \frac{3^n}{n^3 + 2\cdot 3^n} = 1/2$ so the series converges.

(c) $\lim_{n\to\infty} \frac{3^n}{n^3 + 2\cdot 3^n} = 1/2$ so the series diverges.

(d) $\lim_{n\to\infty} \frac{3^n}{n^3 + 2\cdot 3^n}$ does not exist so the series converges.

(e) $\lim_{n\to\infty} \frac{3^n}{n^3 + 2\cdot 3^n} = 0$ so the series diverges.

19.(6 pts.) Sum the series $\sum_{n=1}^{\infty} \frac{7^n}{5^{2n}}$.

(a) $\frac{25}{22}$ (b) $\frac{7}{18}$ (c) $\frac{5}{7}$ (d) $\frac{96}{25}$ (e) $\frac{3}{22}$

20.(6 pts.) The interval of convergence of the series

$$\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{n}} (x+3)^n$$

is

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

(d) $(2, 4)$ (e) $(-4, -2]$

21.(6 pts.) Which series below absolutely converges?

(a) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n n!}{n^3}$ (b) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{\ln(n+1)}$ (c) $\displaystyle\sum_{n=1}^{\infty} \frac{\sqrt{n^3}}{n^2+1}$ (d) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^{n-1}\pi^n}{3^n}$

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

22.(6 pts.) Which series below conditionally converges? **These are the same series as in problem 21**.

(a) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n n!}{n^3}$ (b) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{\ln(n+1)}$ (c) $\displaystyle\sum_{n=1}^{\infty} \frac{\sqrt{n^3}}{n^2+1}$ (d) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^{n-1}\pi^n}{3^n}$

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

23.(6 pts.) Find a power series for the function

$$f(x) = -\frac{3}{(x+1)^2}.$$

centered at 1.

(a) $\frac{3}{2}\sum_{n=1}^{\infty}(-1)^n n\frac{(x-1)^{n-1}}{2^n}$

(b) $\frac{3}{2}\sum_{n=0}^{\infty}\frac{(-1)^n}{(n+1)}\frac{(x-1)^{n+1}}{2^n}$

(c) $\frac{3}{2}\sum_{n=1}^{\infty} n\frac{(x-1)^{n-1}}{2^n}$

(d) $\frac{3}{2}\sum_{n=0}^{\infty}(-1)^n\frac{(x-1)^n}{2^n}$

(e) $\frac{3}{2}\sum_{n=1}^{\infty}(-1)^n n\frac{(x-1)^n}{2^n}$

24.(6 pts.) Which series below represents $\dfrac{\sin x - x}{x^3}$?

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

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

(c) $\displaystyle\sum_{n=1}^{\infty}\frac{(-1)^n x^{2n-2}}{(2n+1)!}$

(d) $\displaystyle\sum_{n=1}^{\infty}(-1)^n\binom{1/2}{n}x^{2n-2}$

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

25.(6 pts.) Which series below gives the arc length of the curve $y = \dfrac{x^3}{3}$ from $x = 0$ to $x = 1$?

(a) $\displaystyle\sum_{n=0}^{\infty} \binom{1/2}{n} \frac{1}{4n+2}$ (b) $\displaystyle\sum_{n=0}^{\infty} \binom{1/3}{n} \frac{1}{4n+1}$ (c) $\displaystyle\sum_{n=0}^{\infty} \binom{1/3}{n} \frac{1}{4n+2}$

(d) $\displaystyle\sum_{n=0}^{\infty} \binom{1/2}{n} \frac{(-1)^n}{4n+1}$ (e) $\displaystyle\sum_{n=0}^{\infty} \binom{1/2}{n} \frac{1}{4n+1}$

Math 126
Final Exam
May 6, 2004

Name: _____

Instructor: _____

- Be sure that you have all 14 pages of the test.
- No calculators are to be used.
- The exam lasts for two hours.
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- The Honor Code is in effect for this examination, including keeping your answer sheet under cover.

Please mark your answers with an **X**! Do NOT circle them!

The dotted lines in the answer box indicate page breaks.

1.	(a)	(b)	(c)	(d)	(e)	15.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)	16.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)	17.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)	18.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)	19.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)	20.	(a)	(b)	(c)	(d)	(e)
7.	(a)	(b)	(c)	(d)	(e)	21.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)	22.	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)	23.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)	24.	(a)	(b)	(c)	(d)	(e)
11.	(a)	(b)	(c)	(d)	(e)	25.	(a)	(b)	(c)	(d)	(e)
12.	(a)	(b)	(c)	(d)	(e)						
13.	(a)	(b)	(c)	(d)	(e)						
14.	(a)	(b)	(c)	(d)	(e)						

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Math 126
Final Exam
May 6, 2004

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2.	(a)	(b)	(•)	(d)	(e)	16.	(a)	(b)	(c)	(•)	(e)
3.	(•)	(b)	(c)	(d)	(e)	17.	(•)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(•)	(d)	(e)	18.	(a)	(b)	(•)	(d)	(e)
5.	(a)	(b)	(c)	(•)	(e)	19.	(a)	(•)	(c)	(d)	(e)
6.	(•)	(b)	(c)	(d)	(e)	20.	(a)	(b)	(c)	(d)	(•)
7.	(a)	(•)	(c)	(d)	(e)	21.	(a)	(b)	(c)	(d)	(•)
8.	(a)	(b)	(•)	(d)	(e)	22.	(a)	(•)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(•)	(e)	23.	(•)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(•)	(e)	24.	(a)	(b)	(•)	(d)	(e)
11.	(a)	(b)	(c)	(d)	(•)	25.	(a)	(b)	(c)	(d)	(•)
12.	(a)	(b)	(c)	(d)	(•)						
13.	(a)	(•)	(c)	(d)	(e)						
14.	(•)	(b)	(c)	(d)	(e)						

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