

Record your answers to the multiple choice problems by placing an \times through one letter for each problem on this page. There are 22 multiple choice questions worth 6 points each. You start with 18 points.

You may not use a calculator.

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1. Find the sum of the series: $\sum_{n=1}^{\infty} \frac{3}{n(n+1)}$.

- (a) 3 (b) 1 (c) 2 (d) 3/2 (e) 5/2

2. Evaluate the integral $\int_0^{\infty} \frac{1}{x^2 + 3x + 2} dx$.

- (a) $\ln(3/2)$ (b) $\ln(1/2)$ (c) $\ln(5/2)$ (d) $\ln(3)$ (e) $\ln(2)$

3. Find the Taylor series of $\sin(x)$ at $a = \pi/2$.

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

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

(e) $\sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} (x - \pi/2)^{2n+1}$

4. Find the area of the surface obtained by rotating the curve $x = 3 \sin t$, $y = 3 \cos t$, $0 \leq t \leq \pi/6$ about the x -axis.

- (a) 12π (b) 9π (c) $3\sqrt{3}\pi/2$ (d) 3π (e) $3\sqrt{2}\pi$

5. Evaluate the integral $\int_0^{\pi/2} x \cos^2(x) dx$.

- (a) $\frac{\pi^2}{4} - 2$ (b) $\frac{\pi^2}{8}$ (c) 0 (d) $\frac{\pi^2}{8} - \frac{1}{2}$ (e) $\frac{\pi^2}{16} - \frac{1}{4}$

6. Suppose $g(x)$ is the inverse of a differentiable function $f(x)$ and let $G(x) = e^{g(x)}$. If $f(3) = 1$ and $f'(3) = 2$, find $G'(1)$.

- (a) $3e^2$ (b) e^3 (c) 2 (d) $e^2/3$ (e) $e^3/2$

7. Find the arc length of the curve $r = 4 \cos^2(\theta/2)$, $0 \leq \theta \leq \pi$.

- (a) 10 (b) $2\sqrt{2}$ (c) 8 (d) $4\sqrt{2}$ (e) 5

8. Compute the derivative of $f(x) = (x + 1)^{\cos x}$.

- (a) $\sin(x)(x + 1)^{\cos x - 1}$ (b) $(x + 1)^{\cos x} \ln(\cos x)$
(c) $\cos(x)(x + 1)^{\cos x - 1}$ (d) $(x + 1)^{\cos x} \left(\frac{\cos x}{x + 1} - \sin(x) \ln(x + 1) \right)$
(e) $x^{\sin x}$

9. Evaluate the integral $\int_0^1 3^{4t} dt$.

- (a) $\frac{3^4 + 1}{4 \ln(3)}$ (b) $\frac{3^4 - 1}{4 \ln(3)}$ (c) $\frac{3^5}{5}$
(d) $4(3^4 - 1) \ln(3)$ (e) $3^4 - 1$

10. Find the sum of the series $\sum_{n=0}^{\infty} \binom{1/2}{n} \frac{1}{3^n}$.

- (a) $\sqrt{2}/3$ (b) $3/2$ (c) $2/\sqrt{3}$ (d) $\sqrt{3}$ (e) $3/\sqrt{2}$

11. Find the slope of the line tangent to the curve $r = 1/\theta$ at the point with $\theta = \pi$.

- (a) $-\pi$ (b) $\pi/2$ (c) $-1/\pi^2$ (d) $\frac{1 - \pi}{1 + \pi}$ (e) $3/\pi$

12. Evaluate the integral $\int_0^1 \frac{\ln(1-x)}{x} dx$ as a series.

(a) $-1 - \frac{1}{2^2} - \frac{1}{3^2} - \frac{1}{4^2} - \dots$

(b) $-\frac{1}{2} - \frac{1}{2 \cdot 3} - \frac{1}{3 \cdot 4} - \frac{1}{4 \cdot 5} - \dots$

(c) $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots$

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

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

13. Use Simpson's Rule with $n = 4$ to approximate $\int_{-2}^2 \frac{1}{x^2 + 2} dx$.

(a) 2

(b) $4/3$

(c) $5/3$

(d) $7/3$

(e) $8/3$

14. The function $y(x)$ satisfies the differential equation $y' = \frac{2x}{3y^2}$ with the initial condition $y(0) = -1$. Find $y(3)$.

(a) $\sqrt{19}$

(b) 1

(c) $8/3$

(d) $\sqrt[3]{10}$

(e) 2

15. Determine the interval of convergence of the power series $\sum_{n=1}^{\infty} \frac{(-1)^n}{4^n \sqrt{n}} (x-1)^{2n}$.

(a) $[-1, 3]$

(b) $(-\infty, \infty)$

(c) $(-2, 4]$

(d) $(-3, 5)$

(e) $[0, 2]$

16. Find the Maclaurin series for $e^{-x/2}$.

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

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

(c) $\sum_{n=0}^{\infty} \frac{1}{2(n!)} x^n$

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

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

17. Evaluate the integral $\int_0^3 \frac{1}{\sqrt{36-x^2}} dx$.

- (a) $\pi/12$ (b) $\pi/3$ (c) $\pi/6$ (d) $\pi/4$ (e) $\pi/2$

18. Compute the limit $\lim_{x \rightarrow 1} \left(\frac{1}{\ln(x)} - \frac{1}{x-1} \right)$.

- (a) 1 (b) $1/e$ (c) 0
(d) $1/2$ (e) *does not exist*

19. Determine which of the following series are convergent.

(I) $\sum_{n=0}^{\infty} (-1)^n \frac{3^n}{n^3 + 3^{n+1}}$ (II) $\sum_{n=1}^{\infty} \frac{\arctan(n)}{n^2 + 1}$ (III) $\sum_{n=2}^{\infty} \frac{\ln(n)}{n^{3/2}}$

- (a) (I), (II) & (III) (b) (II) & (III) (c) (II)
(d) (I) & (III) (e) (I) & (II)

20. Find the coordinates of the centroid of the region below the graph of $f(x) = 4 - x^2$ and above the x -axis. The area of the region is $32/3$.

- (a) (0, 3) (b) (0, $12/5$) (c) (0, $9/5$) (d) (0, 2) (e) (0, $8/5$)

21. Evaluate the integral $\int_0^{\infty} \frac{1}{\sqrt{x}} dx$.

- (a) 10 (b) 1 (c) $1/\sqrt{2}$ (d) *diverges* (e) 2

22. Find the third degree Taylor polynomial for $f(x) = \tan(x)$ at $a = 0$.

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

Answer Key 1

MATH 10560: Calculus II

Name: _____

Final Exam December 16, 2005

Instructor: _____

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