

1. (5 pts.) Find an equation of the tangent line to the curve $y = 9e^{2x} \cos \pi x$ at the point $(0, 9)$.

- a) $y = 18x + 9$
 b) $y = 2x + 4$
 c) $y = 5x + 9$
 d) $y = 5x + 4$
 e) $y = 18x + 2$

2. (5 pts.) Evaluate $\lim_{x \rightarrow \infty} [\ln(10 + x) - \ln(5 + x)]$.

- a) 2
 b) -5
 c) 5
 d) 0
 e) ∞

3. (5 pts.) Differentiate the function $f(\theta) = \ln(\cos(4\theta))$.

- a) $f'(\theta) = \frac{1}{\cos(4\theta)}$
 b) $f'(\theta) = -4 \cot(4\theta)$
 c) $f'(\theta) = -4 \tan(4\theta)$
 d) $f'(\theta) = \frac{4}{\cos(4\theta)}$
 e) $f'(\theta) = 4 \ln(\sin(4\theta))$

4. (5 pts.) Evaluate $\int_0^{-\frac{\sqrt{2}}{2}} \frac{\sin^{-1} x}{\sqrt{1-x^2}} dx$.

- a) $\frac{\pi^2}{32}$
 b) $-\frac{\pi^2}{16}$
 c) $-\frac{\pi^2}{32}$
 d) $\frac{\pi^2}{16}$
 e) $\frac{\sqrt{2}\pi^2}{2}$

5. (5 pts.) Evaluate $\lim_{x \rightarrow \infty} x^2 e^{-x^2}$.

- a) 1
 b) 0
 c) $-\infty$
 d) ∞
 e) 2

6. (5 pts.) Evaluate $\int \theta \cos \theta d\theta$.

- a) $\theta \cos \theta + \sin \theta + C$
 b) $-\theta \sin \theta + C$
 c) $\sin \theta + \cos \theta + C$
 d) $\theta \sin \theta + \cos \theta + C$
 e) $\theta \sin \theta - \cos \theta + C$

7. (5 pts.) Evaluate $\int_0^{\frac{\pi}{8}} \cos^5 4x dx$.

- a) $\frac{2}{5}$
 b) $\frac{2}{3}$
 c) $\frac{32}{15}$
 d) $\frac{7}{15}$
 e) $\frac{2}{15}$

8. (5 pts.) Evaluate $\int \frac{x+17}{(x+5)(x-7)} dx$.

- a) $\ln|(x-7)^2(x+5)| + C$
 b) $\ln \left| \frac{x-7}{x+5} \right| + C$
 c) $\ln \left| \frac{(x-7)^2}{x+5} \right| + C$
 d) $\ln \left| \frac{x+5}{(x-7)^2} \right| + C$
 e) $\ln|(x+5)(x-7)| + C$

9. (5 pts.) Evaluate $\int \sin^2 x \cos x dx$.

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

10. (5 pts.) Evaluate $\int_{-\infty}^{-6} \frac{1}{\sqrt{3-x}} dx$.
- The integral is divergent.
 - 10
 - 14
 - 16
 - 6
11. (5 pts.) Find a Cartesian equation of the curve $x = 4t^2$ and $y = -64t^3$.
- $x = 4y^{\frac{2}{3}}$
 - $x = \frac{1}{4}y^{\frac{2}{3}}$
 - $x = \frac{1}{4}y^{\frac{3}{2}}$
 - $x = 4y^{\frac{3}{2}}$
 - $x = -4y^{\frac{3}{2}}$
12. (5 pts.) Find an equation of the tangent to the curve $x = e^{\sqrt{t}}$, $y = t - \ln t^2$ at the point $t = 1$.
- $y = -\frac{2}{e}x + 2$
 - $y = \frac{2}{e}x$
 - $y = -\frac{2}{e}x + 3$
 - $y = \frac{2}{e}x + 2 + e$
 - $y = -\frac{2}{e}x + \frac{2}{e} + e$
13. (5 pts.) Find a polar equation for the curve represented by the Cartesian equation $x^2 = 8y$.
- $r = 8 \tan \theta \sec \theta$
 - $r = 8 \tan \theta \sin \theta$
 - $r = 8 \cos \theta \sin \theta$
 - $r = 8 \tan \theta$
 - $r = 8 \cos \theta$
14. (5 pts.) Determine whether the sequence $\left\{ \frac{7 + 4n^2}{n + n^2} \right\}$ converges or diverges. If it converges, find the limit.
- converges to 1
 - converges to 4
 - converges to 0
 - converges to 7
 - diverges
15. (5 pts.) Determine whether the sequence $\left\{ \frac{(-1)^{n-1}n}{n^2 + 5} \right\}$ converges or diverges. If it converges, find the limit.
- converges to 1
 - converges to 0
 - converges to $-\frac{1}{5}$
 - converges to $\frac{1}{5}$
 - diverges
16. (5 pts.) Find the set of values of q for which the series $\sum_{k=6}^{\infty} \frac{1}{k \ln k |\ln(\ln k)|^q}$ is convergent.
- $q = 1$
 - $q > 1$
 - $q \leq 1$
 - $q < 1$
 - $q \geq 1$
17. (5 pts.) Find the radius of convergence and interval of convergence of the series $\sum_{n=1}^{\infty} \frac{x^n}{n5^n}$.
- $R = 5, I = (0, 5)$
 - $R = \frac{1}{5}, I = \left(-\frac{1}{5}, 0\right]$
 - $R = \frac{1}{5}, I = \left(-\frac{1}{5}, \frac{1}{5}\right)$
 - $R = 5, I = [-5, 5)$
 - $R = \frac{1}{5}, I = \left[-\frac{1}{5}, 0\right)$

18. (5 pts.) Find a power series representation for $f(t) = \ln(9 - t)$ by using $\ln(1 - x) = -\sum_{n=1}^{\infty} \frac{x^n}{n}$.

a) $\sum_{n=0}^{\infty} \frac{t^n}{9^n}$

b) $\ln 9 - \sum_{n=1}^{\infty} \frac{t^n}{n9^n}$

c) $-\sum_{n=0}^{\infty} \frac{t^n}{n9^n}$

d) $\ln 9 + \sum_{n=1}^{\infty} \frac{t^n}{9^n}$

e) $-\sum_{n=1}^{\infty} \frac{t^n}{n9^n}$

20. (5 pts.) Determine whether the series $\sum_{n=1}^{\infty} \frac{6^n + 5^n}{30^n}$ is convergent or divergent. If it is convergent, find its sum.

a) $\frac{6}{5}$

b) $\frac{3}{10}$

c) $\frac{9}{20}$

d) $\frac{5}{6}$

e) divergent

19. (5 pts.) Find the Maclaurin series for $f(x) = (1 + x)^{-3}$.

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

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

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

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

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

For each series below, determine whether it is absolutely convergent, conditionally convergent, or divergent. **Code on your scantron sheet A** if the series is *Absolutely convergent*, **C** if it is *Conditionally convergent*, or **D** if it is *Divergent*.

21. (3 pts.) $\sum_{n=2}^{\infty} \frac{n^2}{n^2 - 1}$

26. (10 pts.) Find the area of the region that lies inside $r = 3 \cos \theta$ and outside $r = 1 + \cos \theta$.

22. (3 pts.) $\sum_{n=1}^{\infty} (-1)^n n e^{-n^2}$

23. (3 pts.) $\sum_{n=1}^{\infty} \frac{\cos(n\pi)}{\sqrt{n}}$

24. (3 pts.) $\sum_{n=1}^{\infty} \frac{n(-3)^n}{4^{n-1}}$

25. (3 pts.) $\sum_{n=2}^{\infty} \frac{(-1)^n}{\ln n}$

27. (10 pts.) Find $\int \frac{x^3}{\sqrt{1-x^2}} dx$.

28. (15 pts.) Let $f(x) = \sin x$.

(a) Find $f(\frac{\pi}{2})$, $f'(\frac{\pi}{2})$, $f''(\frac{\pi}{2})$, $f'''(\frac{\pi}{2})$, $f^{(4)}(\frac{\pi}{2})$, and $f^{(5)}(x)$.

$$f(x) =$$

$$f(\frac{\pi}{2}) =$$

$$f'(x) =$$

$$f'(\frac{\pi}{2}) =$$

$$f''(x) =$$

$$f''(\frac{\pi}{2}) =$$

$$f'''(x) =$$

$$f'''(\frac{\pi}{2}) =$$

$$f^{(4)}(x) =$$

$$f^{(4)}(\frac{\pi}{2}) =$$

$$f^{(5)}(x) =$$

(b) Use your answers in part (a) to write down the fourth degree Taylor polynomial for $f(x) = \sin x$ at $a = \frac{\pi}{2}$.

(c) Find the Taylor series for $f(x) = \sin x$ at $a = \frac{\pi}{2}$.

ITEM NO. FORM: A

1	A
2	D
3	C
4	A
5	B
6	D
7	E
8	C
9	C
10	A
11	B
12	C
13	A
14	B
15	B
16	B
17	D
18	B
19	A
20	C
21	D
22	A
23	C
24	A
25	C

26. π

27. $-\sqrt{1-x^2} + \frac{1}{3}(1-x^2)^3 + C = -\frac{1}{3}\sqrt{1-x^2}(2+x^2) + C$ (either form ok)

28. a) 1,0,-1,0,1,0

b) $T_4(x) = 1 - \frac{1}{2}\left(x - \frac{\pi}{2}\right)^2 + \frac{1}{24}\left(x - \frac{\pi}{2}\right)^4$

c) $T(x) = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n)!} \left(x - \frac{\pi}{2}\right)^{2n}$