

1. The integral $\int_1^e 9x^2 \ln x dx$ is equal to

- (a) $2e^3 + 3$
- (b) $2e^3 - 2$
- (c) $3e^3 - 1$
- (d) $2e^3 + 1$
- (e) $3e^3 + 1$

2. The integral $\int \sin 2\theta \cos \theta d\theta$ is equal to

- (a) $-\frac{2}{3} \sin^3 \theta + C$
- (b) $-\frac{1}{3} \cos 3\theta + C$
- (c) $\frac{1}{3} \sin 3\theta + C$
- (d) $-\frac{2}{3} \cos^3 \theta + C$
- (e) $\frac{1}{4} \sin^2 2\theta + C$

3. The integral $\int_0^1 \frac{dx}{(x^2 + 1)^{\frac{3}{2}}}$ is equal to

- (a) $\frac{\sqrt{2}}{2} - 1$
- (b) $\frac{\sqrt{2}}{2} + 1$
- (c) $\frac{\sqrt{2}}{2}$
- (d) $\sqrt{2}$
- (e) $\sqrt{2} - 1$

4. The integral $\int_0^1 \frac{x^2-5x+7}{x^2-5x+6} dx$ is equal to

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

5. The integral $\int_{-\infty}^{\infty} x^2 e^{-x^3} dx$

- (a) converges to $\frac{1}{3}$.
- (b) converges to $\frac{1}{6}$.
- (c) diverges.
- (d) converges to 0.
- (e) converges to $\frac{2}{3}$.

6. The series $\sum_{n=1}^{\infty} \frac{1}{n \sqrt[n]{n}}$

- (a) diverges by limit comparison test with $\sum_{n=1}^{\infty} \frac{1}{n}$
- (b) converges by limit comparison test with $\sum_{n=1}^{\infty} \frac{1}{n}$
- (c) converges by limit comparison test with $\sum_{n=1}^{\infty} \frac{1}{\sqrt[n]{n}}$
- (d) converges by comparison test with $\sum_{n=1}^{\infty} \frac{1}{\sqrt[n]{n}}$
- (e) diverges because $\lim_{n \rightarrow \infty} \frac{1}{n \sqrt[n]{n}} = \frac{1}{e}$.

7. The series $\sum_{n=1}^{\infty} (-1)^n \left(\frac{n}{4n^2+1}\right)$
- (a) diverges.
 - (b) converges.
 - (c) converges absolutely.
 - (d) diverges by comparison with $\sum_{n=1}^{\infty} \frac{1}{n}$.
 - (e) converges because $\lim_{n \rightarrow \infty} \left(\frac{n}{4n^2+1}\right) = 0$.
8. The series $\sum_{n=1}^{\infty} (-1)^n \frac{n^2 2^n}{n!}$
- (a) converges conditionally.
 - (b) diverges by ratio test.
 - (c) diverges by integral test.
 - (d) diverges by root test.
 - (e) converges absolutely.
9. The limit $\lim_{n \rightarrow +\infty} \sum_{i=1}^n \frac{3}{n} \sqrt{1 + \frac{3i}{n}}$ represents the area of the region under the graph of
- (a) $y = \sqrt{x}$ on the interval $[0, 3]$
 - (b) $y = \sqrt{x+1}$ on the interval $[1, 4]$
 - (c) $y = \sqrt{x}$ on the interval $[1, 4]$
 - (d) $y = \sqrt{x+1}$ on the interval $[0, 4]$
 - (e) $y = \sqrt{x+1}$ on the interval $[1, 3]$

10. Use the properties of the integrals to determine which of the following relations is **correct**

(a) $\int_1^3 \sqrt{x^4 + 1} dx \geq \frac{26}{3}$

(b) $2 < \int_1^3 \sqrt{x^4 + 1} dx < 2\sqrt{2}$

(c) $\int_1^3 \sqrt{x^4 + 1} dx < 0$

(d) $2\sqrt{2} < \int_1^3 \sqrt{x^4 + 1} dx < \frac{26}{3}$

(e) $0 < \int_1^3 \sqrt{x^4 + 1} dx \leq 2$

11. The integral $\int_0^2 |x - x^2| dx$ is equal to

(a) $-2/3$

(b) 1

(c) -1

(d) $5/6$

(e) $2/3$

12. The integral $\int_0^{\frac{\pi^2}{9}} \sin \sqrt{x} dx$ is equal to

(a) $2 \sin \frac{\pi^2}{9} - \frac{2\pi^2}{9} \cos \frac{\pi^2}{9}$

(b) $\frac{\pi\sqrt{3}}{2} - 1$

(c) $1 - \cos \frac{\pi^2}{9}$

(d) $\frac{\sqrt{3}}{2} - \frac{\pi}{6}$

(e) $\sqrt{3} - \frac{\pi}{3}$

13. The interval of convergence of the power series $\sum_{n=1}^{\infty} \frac{(2x-1)^n}{n^3}$ is

- (a) $[0, 1/2]$
- (b) $[0, 1]$
- (c) $(0, 1)$
- (d) $(-\infty, +\infty)$
- (e) $\{0\}$

14. If the first three nonzero terms of the Maclaurin series for $\tan^{-1} x$ are used, then the approximation of $\tan^{-1} 1$ is:

- (a) $13/15$
- (b) $11/15$
- (c) $2/5$
- (d) $23/5$
- (e) $14/15$

15. The Maclaurin series for the function $f(x) = \frac{1-\cos x}{x^2}$, $x \neq 0$ is

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

16. For $x \neq 0$, the sum of the series $\sum_{n=0}^{\infty} \frac{x^n}{2^n(n+1)!}$ is equal to

- (a) $e^{\frac{x}{2}} - 1 - \frac{x^2}{4}$
- (b) $\frac{1}{2} \sin x$
- (c) $\frac{x}{2} \cos x$
- (d) $\frac{2e^x}{x}$
- (e) $\frac{2}{x}(e^{\frac{x}{2}} - 1)$

17. The area of the region enclosed by the graphs of $y = \frac{1}{x}$, $y = \frac{1}{x^2}$ and $x = 2$ is equal to

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

18. The volume of the solid obtained by rotating the region bounded by the curves of $y = \sqrt{x-1}$, $x = 2$, $x = 5$ and $y = 0$ about the x-axis is equal to

- (a) 21π
- (b) 15π
- (c) $15\pi/2$
- (d) $21\pi/2$
- (e) $15\pi/4$

19. The volume generated by rotating the region bounded by the graphs of $y = x^2$, $y = 0$, $x = 1$, and $x = 2$ about $x = 4$ is equal to

- (a) $14\pi/3$
- (b) $67\pi/2$
- (c) 67π
- (d) $67\pi/6$
- (e) $7\pi/6$

20. The length of the curve $y = \frac{x^2}{2} - \frac{\ln x}{4}$, $2 \leq x \leq 4$ is equal to

- (a) $6 + \frac{\ln 2}{4}$
- (b) $6 - \ln 2$
- (c) $6 - \frac{\ln 2}{4}$
- (d) $6 + \ln 2$
- (e) $6 - \ln 3$

21. The area of the surface obtained by rotating the curve $x = \frac{1}{3}(y^2 + 2)^{\frac{3}{2}}$, $1 \leq y \leq 2$, about the x -axis is equal to

- (a) 21π
- (b) $21\pi/2$
- (c) $21\pi/4$
- (d) $20\pi/3$
- (e) 20π

22. The sequence $a_n = \frac{\sqrt{n}}{1+\sqrt{n}}$
- (a) converges and the limit is 1
 - (b) diverges
 - (c) converges and the limit is $\sqrt{2}$
 - (d) converges and the limit is $\frac{\sqrt{2}}{1+\sqrt{2}}$
 - (e) converges and the limit is 0
23. The series $\sum_{n=1}^{\infty} \frac{3^n+2^n}{6^n}$ is
- (a) convergent and the sum is 7
 - (b) convergent and the sum is 3
 - (c) divergent
 - (d) convergent and the sum is $5/2$
 - (e) convergent and the sum is $3/2$

24. The series $\sum_{n=2}^{\infty} \frac{1}{n \ln n}$ is

- (a) divergent by the integral test
- (b) convergent by the integral test
- (c) convergent by the comparison test
- (d) convergent because $\lim_{n \rightarrow \infty} \frac{1}{n \ln n} = 0$
- (e) convergent by the ratio test

25. The integral $\int_0^1 \frac{dx}{1+\sqrt[3]{x}}$ is equal to

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