

1. Evaluate:

$$\int_1^2 \left(x + \frac{1}{x}\right)^3 dx$$

- A. $\frac{369}{64}$ B. $\frac{63}{8} + \ln(8)$ C. $\frac{69}{8} + \ln(8)$ D. $9 + \ln(8)$ E. NOTA

2. Evaluate:

$$\int_0^1 x\sqrt{1-x} dx$$

- A. $\frac{\sqrt{2}}{8}$ B. $\frac{4}{15}$ C. $\frac{1}{4}$ D. 1 E. NOTA

3. Evaluate:

$$\int_0^1 x\sqrt{1-x^4} dx$$

- A. $\frac{\pi}{8}$ B. $\frac{\pi}{4}$ C. $\frac{\pi}{2}$ D. DNE E. NOTA

4. Evaluate a midpoint Riemann approximation with $n = 4$ equal subintervals on the integral

$$\int_0^4 (x^3 - 6x^2 + 13x - 7) dx$$

- A. 2 B. 4 C. 12 D. 22 E. NOTA

5. Evaluate:

$$\int_0^4 |x^2 - 3x + 2| dx$$

- A. $\frac{14}{3}$ B. 5 C. $\frac{16}{3}$ D. $\frac{17}{3}$ E. NOTA

6. Given that $f(x) = \max(kx - x^2, 0)$ and that $f(x)$ is a probability density function (PDF), find k . If $f(x)$ is a PDF, area bounded between $f(x)$ and the x-axis is 1.

A. 1 B. $\sqrt[3]{3}$ C. $\sqrt[3]{6}$ D. 2 E. NOTA

7. Evaluate:

$$\int_0^1 \frac{x^6}{\sqrt{1-x^2}} dx$$

A. $\frac{1}{7}$ B. $\frac{8}{15}$ C. $\frac{5\pi}{16}$ D. DNE E. NOTA

8. Evaluate:

$$\lim_{n \rightarrow \infty} \sum_{i=1}^n \frac{i^{n-1}}{n^n}$$

A. 0 B. $\frac{1}{e}$ C. 1 D. DNE E. NOTA

9. Find the average value of $f(x) = x^3 + 2x^2 + 3x + 4$ on the interval (0,4).

A. $\frac{110}{3}$ B. $\frac{440}{3}$ C. 42 D. 168 E. NOTA

10. Evaluate:

$$\int_0^\infty \frac{1}{x^4 + 1} dx$$

A. $\frac{\pi}{8}$ B. $\frac{\pi\sqrt{2}}{8}$ C. $\frac{\pi}{4}$ D. $\frac{\pi\sqrt{2}}{4}$ E. NOTA

11. If $\int_1^2 \frac{4x^2+9x+2}{x^3+3x^2+x} dx = \ln\left(\frac{a}{b}\right)$ where $\frac{a}{b}$ is a simplified fraction, find $a + b$.

A. 27 B. 49 C. 71 D. 93 E. NOTA

12. If a needle of length 1 inch is randomly thrown on an infinitely large grid of 1x1 squares, find the probability that it touches at least 1 of the lines.

A. $\frac{1}{2}$ B. $\frac{2}{\pi}$ C. $\frac{3}{\pi}$ D. 1 E. NOTA

13. Evaluate:

$$\int_{-1}^1 \frac{x^2 \sin(x)}{x^2 + 1} dx$$

A. 0 B. $\frac{\pi}{4} \sin 1$ C. $\frac{\pi}{2} \sin 1$ D. $\pi \sin 1$ E. NOTA

14. Find the maximum value of $f(x) = \int_0^x (6t - t^2 - 5) dt$

A. $-\frac{7}{3}$ B. 0 C. $\frac{25}{3}$ D. $\frac{32}{3}$ E. NOTA

15. Find the volume when the region bounded by $y = x^2 + 3x + 5$, $x = 0$, $x = 1$ and $y = 0$ is revolved around the x -axis.

A. $\frac{1441\pi}{30}$ B. $\frac{1441\pi}{15}$ C. $\frac{1541\pi}{30}$ D. $\frac{1541\pi}{15}$ E. NOTA

16. Find the area bounded by the graphs of $y = x^3 - 6x^2 + 12x$ and $y = x^2 - 2x + 8$.

A. $\frac{5}{12}$ B. $\frac{27}{12}$ C. $\frac{8}{3}$ D. $\frac{37}{12}$ E. NOTA

17. John decides to go on a run and is traveling along a straight line. John's velocity can be modeled by $v(t) = 3t + \sqrt{t} - 1$ meters per second for $0 \leq t \leq 4$ seconds. What is John's displacement over the interval $0 \leq t \leq 4$ seconds?

A. $\frac{58}{3}$ B. $\frac{64}{3}$ C. $\frac{70}{3}$ D. $\frac{76}{3}$ E. NOTA

18. Evaluate:

$$\int_0^{\infty} \frac{1}{x^6 + x^4 + x^2 + 1} dx$$

A. $\frac{\pi}{8}$ B. $\frac{\pi}{4}$ C. $\frac{\pi}{2}$ D. π E. NOTA

19. Evaluate $\int_{-\infty}^{\infty} x^6 e^{-x^2} dx$ given that $\int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi}$

A. $\frac{3\sqrt{\pi}}{4}$ B. $\sqrt{\pi}$ C. $\frac{15\sqrt{\pi}}{8}$ D. $6\sqrt{\pi}$ E. NOTA

20. Evaluate:

$$\lim_{a \rightarrow 0} \int_0^a \frac{a}{a^2 + x^2} dx$$

A. 0 B. $\ln(2)$ C. $\frac{\pi}{4}$ D. DNE E. NOTA

21. Evaluate:

$$\int_0^{\frac{2\pi}{3}} \sec\left(\frac{x}{2}\right) \tan\left(\frac{x}{2}\right) dx$$

A. 1 B. $\frac{3}{2}$ C. 2 D. $\frac{5}{2}$ E. NOTA

22. Evaluate:

$$\int_0^{\infty} e^{-x} ([x])^2 dx$$

A. $\frac{1}{e-1}$ B. $\frac{e}{(e-1)^2}$ C. $\frac{e+1}{(e-1)^2}$ D. 2 E. NOTA

23. Evaluate:

$$\int_0^1 \frac{x}{(1+7x^2)^2} dx$$

- A. $\frac{1}{16}$ B. $\frac{1}{8}$ C. $\frac{1}{4}$ D. $\frac{1}{2}$ E. NOTA

24. Evaluate:

$$\lim_{n \rightarrow \infty} \sum_{i=0}^{n^2} \frac{i}{n^2}$$

- A. 0 B. $\frac{1}{2}$ C. 1 D. $\frac{3}{2}$ E. NOTA

25. Evaluate:

$$\int_0^{2\pi} \sec^2\left(\frac{x}{8}\right) dx$$

- A. 2 B. 4 C. 8 D. 16 E. NOTA

26. Solve the following equation for a :

$$\int_0^1 (ax^2 + x + a) dx = 3a$$

- A. 0.1 B. 0.2 C. 0.3 D. 0.4 E. NOTA

27. How many of the following are true?

I: If $\int_0^\infty f(x) dx$ converges, then $\int_0^\infty \frac{f(x)}{x} dx$ also converges

II: If $\int_0^\infty f(x) dx$ converges, then $\lim_{n \rightarrow \infty} f(n) = 0$

III: If $\int_0^\infty f(x) dx$ converges, then $\int_0^\infty xf(x) dx$ also converges

- A. 0 B. 1 C. 2 D. 3 E. NOTA

28. Evaluate:

$$\int_0^{\infty} \frac{1}{(1+x)(1+(\ln x)^2)} dx$$

A. $\frac{\pi}{4}$ B. $\frac{\pi}{2}$ C. π D. DNE E. NOTA

29. Evaluate:

$$\int_0^{\frac{\pi}{4}} 2 \tan x (\sin^2 x) e^{(\tan^2 x)} dx$$

A. $\frac{e-2}{2}$ B. $\frac{e}{2}$ C. $e-2$ D. e E. NOTA

30. To end this test off on an easy note, evaluate:

$$\lim_{x \rightarrow 0} \sqrt{\sin x}$$

A. 0 B. $\frac{1}{2}$ C. 1 D. 2 E. NOTA