

For all questions, "E. NOTA" means none of the answers is correct. Unless otherwise stated, assume all numbers are real.

1. Evaluate $\lim_{x \rightarrow 1} \frac{x^7 - 1}{x^{12} - 1}$.

- A. 0 B. $\frac{7}{12}$ C. 1 D. ∞ E. NOTA

2. Evaluate $\lim_{x \rightarrow 5^+} \frac{8}{5 - x}$.

- A. 0 B. $\frac{4}{5}$ C. $-\infty$ D. ∞ E. NOTA

3. Let $f(x) = 1 + \sin^2 x^5$. Find $f' \pi$.

- A. -5 B. 0 C. 1 D. 10 E. NOTA

4. Find the slope of the line tangent to the graph of $x^2 + 2xy - y^2 + x = 2$ at the point $(1, 2)$.

- A. $\frac{1}{2}$ B. $\frac{3}{2}$ C. $\frac{5}{2}$ D. $\frac{7}{2}$ E. NOTA

5. Find the 27th derivative of $x \cos x$.

- A. $-x \cos x - 2 \sin x$ B. $x \sin x - 3 \cos x$
C. $x \sin x - 27 \cos x$ D. $-x \cos x - 27 \sin x$ E. NOTA

6. Let $y = \tan 3x$. Find $\frac{d^2 y}{dx^2}$.

- A. $3 \sec^2 3x$ B. $6 \sec 3x \tan 3x$
C. $6 \sec^2 3x \tan 3x$ D. $18 \sec^2 3x \tan 3x$ E. NOTA

7. Let $f(x) = \frac{x+1}{x-1}$. Find $f' 0$.

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

8. For $x^2 + 16y^2 = 16$, find y'' at the point $(0, 1)$.

- A. -1 B. $-\frac{1}{16}$ C. 0 D. $\frac{1}{16}$ E. NOTA

9. Find the critical numbers of the function $g(x) = 3\sqrt[3]{x} + \sqrt[3]{x^4}$.

- A. $-\frac{4}{3}$ B. $-\frac{3}{4}$ C. $-\frac{3}{4}$ and 0 D. $-\frac{4}{3}$ and 0 E. NOTA

10. Where does the absolute maximum value of $f(x) = \frac{2}{3}x^3 - \frac{1}{2}x^2 - 6x + 7$ occur on the interval $[0, 3]$?

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

11. Evaluate $\lim_{x \rightarrow \infty} \frac{\sqrt[3]{27x^3 - 9x^2 + 17x + 4}}{\sqrt{25x^2 + 6x - 1}}$.

- A. 0 B. $\frac{3}{5}$ C. $\frac{27}{25}$ D. ∞ E. NOTA

12. A car's speedometer reads 55 mi/hr at 4:30 p.m. At 4:45 p.m. it reads 70 mi/hr . By the Mean Value Theorem, at some time between 4:30 and 4:45, the acceleration of the car **must** be exactly...

- A. 0 mi/hr^2 B. 1 mi/hr^2 C. 15 mi/hr^2 D. 60 mi/hr^2 E. NOTA

13. What positive real number exceeds its cube by the most?

- A. $\frac{\sqrt{3}}{9}$ B. $\frac{\sqrt{3}}{3}$ C. $\sqrt{3}$ D. ∞ E. NOTA

14. Let $F(x) = \int_{\cos x}^4 \frac{1+t^2}{\sqrt{t}} dt$. Find $F'(0)$.

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

15. Evaluate $\int_1^2 \frac{x + 3x^5}{x^2} dx$.

- A. $\frac{41}{2}$ B. $\frac{51}{4}$ C. $\frac{45}{4} + \ln 2$ D. $\frac{51}{4} + \ln 2$ E. NOTA

16. Evaluate $\int_1^2 \frac{e^{1/x}}{x^2} dx$.

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

17. Find the volume of the solid formed by revolving the region bounded by $y = x^2 + 2$, $x = 1$, the x-axis, and the y-axis about the y-axis.

- A. $\frac{5\pi}{4}$ B. $\frac{5\pi}{2}$ C. $\frac{83\pi}{15}$ D. 6π E. NOTA

18. Let $y = x^2 e^{x \sin x}$. Find y' .

- A. $e^{\sin 1}$ B. $3 \sin 1 \cdot e^{\sin 1}$ C. $3 \sin 1 + \cos 1$ D. $e^{\sin 1} (3 \sin 1 + \cos 1)$ E. NOTA

19. Evaluate $\int_0^2 t^2 e^t dt$.

- A. $2e^2 + 2$ B. $2e^2 - 2$ C. $8e^2 + 2$ D. $8e^2 - 2$ E. NOTA

20. Evaluate $\int_0^{2\sqrt{3}} \frac{x^3}{\sqrt{16 - x^2}} dx$.

- A. 1 B. $\frac{20}{3}$ C. $\frac{40}{3}$ D. $12\sqrt{3}$ E. NOTA

21. Which integral calculates the area inside the small loop of the polar curve

$$r = \sqrt{3} + 2 \sin \theta ?$$

- A. $\frac{1}{2} \int_{7\pi/6}^{11\pi/6} r^2 d\theta$ B. $\frac{1}{2} \int_{3\pi/2}^{5\pi/3} r^2 d\theta$ C. $\int_{3\pi/2}^{5\pi/3} r^2 d\theta$ D. $\int_{7\pi/6}^{11\pi/6} r^2 d\theta$ E. NOTA

22. Find the eccentricity of the conic section represented by the polar equation

$$r = \frac{6}{3 + 2\sin\theta}.$$

- A. $\frac{1}{3}$ B. $\frac{1}{2}$ C. $\frac{2}{3}$ D. 6 E. NOTA

23. Evaluate $\lim_{n \rightarrow \infty} \left[\ln \left(1 + \frac{2}{n} \right)^n \right]$.

- A. 0 B. 1 C. 2 D. ∞ E. NOTA

24. Find the interval of convergence of the series $\sum_{n=1}^{\infty} -1^n \frac{x+2}{n \cdot 2^n}$.

- A. $[-4, 0)$ B. $(-4, 0]$ C. $[0, 4)$ D. $(0, 4]$ E. NOTA

25. The base of S is an elliptical region with boundary curve $4x^2 + 9y^2 = 36$. Cross-sections perpendicular to the x-axis are isosceles right triangles with hypotenuse in the base. Find the volume of S .

- A. 16 B. $16\sqrt{2}$ C. 32 D. $32\sqrt{2}$ E. NOTA