

1. Evaluate: $\lim_{x \rightarrow \pi/2} \frac{\sin x}{x}$
- a. 0 b. $2/\pi$ c. 1 d. $\pi/2$ e. NOTA
2. Which of the following is true of the graph of $f(x) = x\sqrt{x^2 - 4}$?
- I. It is symmetric with respect to the origin
 II. it passes through the origin.
 III. It has vertical tangent lines at ± 2
- a. I, II, and III b. I and III c. I and II d. II and III e. NOTA
3. If $f(x) = \ln(x)$ and $g(x) = 1/x^2$, which of the following is equivalent to $f(g(x))$?
- a. $-2(\ln x)$ b. $-2 \ln|x|$ c. $\frac{1}{\ln x^2}$ d. $\frac{1}{2 \ln|x|}$ e. NOTA
4. Evaluate $\lim_{x \rightarrow 2} \frac{\sqrt{8 - x^2} - x}{x - 2}$
- a. 2 b. 0 c. -2 d. ∞ e. NOTA
5. Evaluate $\lim_{x \rightarrow 0} \frac{e^x - \ln(1 + x) - 1}{x^2}$
- a. -1 b. 0 c. $1/2$ d. ∞ e. NOTA
6. If $f(x) = (x + 2)^3(3 - x)^4$; find $f'(x)$.
- a. $(x+2)^2(7x-1)(x-3)^3$ b. $(x+2)^2(3-x)^3(7x-1)$ c. $(x+2)^3(3-x)^2(1-7x)$
 d. $(x+2)^2(x-3)^3(1-7x)$ e. NOTA
7. Find dy/dx if $y = \tan^3 4x$
- a. $3\tan^2 4x$ b. $12\tan^2 4x$ c. $12\tan^2 4x \sec^2 4x$ d. $12\tan 4x \sec^2 4x$ e. NOTA
8. Find dy/dx if $\tan(x + y) = x$
- a. $\frac{\sec^2(x+y)-1}{\sec^2(x+y)}$ b. $\frac{1-\sec(x+y)}{\sec(x+y)}$ c. $\frac{-x^2}{x^2+1}$ d. $\cos^2(x+y)$ e. NOTA
9. Find an equation of the line tangent to $y = e^x$ which passes through the origin.
- a. $y = ex$ b. $y = \sqrt{e}x$ c. $y = x$ d. $y = (\ln 4)x$ e. NOTA
10. $\frac{d(-1/2 \sin 2x)}{dx} =$
- a. $-1/4 \cos 2x$ b. $-1/2 \cos 2x$ c. $\cos 2x$ d. $\sin^2 x - \cos^2 x$ e. NOTA

11. Find the n th derivative of $f(x) = \frac{1}{x+1}$.

- a. $\frac{n!}{(x+1)^{n+1}}$ b. $\frac{(-1)^n n!}{(x+1)^n}$ c. $\frac{n!}{(x+1)^n}$ d. $\frac{(-1)^n n!}{(x+1)^{n+1}}$ e. NOTA

12. Find $a + b$ so that f is both continuous and differentiable:

$$f(x) = \begin{cases} x^2 + bx + 2, & \text{if } x \geq 1 \\ 2ax^2 + b, & \text{if } x < 1 \end{cases}$$

- a. 6 b. 4 c. 2 d. 0 e. NOTA

13. Evaluate: $\lim_{h \rightarrow 0} \frac{e^{2(x+h)} - e^{2x}}{h}$

- a. $\frac{e^{2x}}{2}$ b. e^{2x} c. 1 d. 0 e. NOTA

14. Find an equation of the normal line to $y = \frac{1}{x^2 + 1}$ at $x = 1$.

- a. $4x - 2y = -5$ b. $2x - y = -3$ c. $x + 2y = 2$ d. $4x - 2y = 3$ e. NOTA

15. Which of the following is NOT an even function?

- a. $y = 2\cos|x|$ b. $y = |\tan x|$ c. $y = 1 + |\cos x|$ d. $y = |\sin x - 1|$ e. NOTA

16. Using the given information, find the value of $(f \circ g)'(6)$.

Given: $f'(6) = -1/2$, $g(6) = 2$, $g'(6) = -1$, $f'(2) = 1$, $f'(-1) = 1/2$

- a. -1 b. -1/2 c. 1/2 d. 1 e. NOTA

17. If $s(t) = t^3 - 12t^2 + 36t - 30$ describes the position of a point at time t as it moves on a horizontal line, find the total distance traveled on $[0, 7]$.

- a. 7 b. 56 c. 63 d. 71 e. NOTA

18. A woman standing on a cliff is watching a motorboat as the boat approaches the shoreline below her. If the telescope is 250 feet above the water level and if the boat is approaching at 25 ft/sec, at what rate is the angle of the telescope changing when the boat is 250 feet from shore? (Rates are in radians/second.)

- a. $1/20$ b. $1/10$ c. $\sqrt{2}/20$ d. $\sqrt{2}/10$ e. NOTA

19. Use differentials to approximate $\sqrt{402}$.

- a. 20.049 b. 20.05 c. 20.051 d. 20.1 e. NOTA

20. What is the minimum value of $f(x) = -2x^3 + 3x^2$ on $[-1, 2]$?

- a. 2 b. 1 c. 0 d. -1 e. NOTA

21. Which of the following is true of the graph of $f(x) = 3x^2 - \frac{1}{x^2}$?
- It has a vertical asymptote at $x = 0$.
 - It has no extrema.
 - It has 2 inflection points.
- a. I, II, and III b. I, II c. I, III d. II, III e. NOTA
22. What conditions on a , b , and c will make $f(x) = ax^3 + bx^2 + cx + d$ always increasing?
- a. $b^2 - 4ac < 0$ and $a > 0$ b. $b^2 < 3ac$ and $a > 0$ c. $b^2 > 3c$ and $a > 0$
d. cannot be determined e. NOTA
23. If $f'(x) = 2(x+2)(x+1)^2(x-2)^4(x-3)^3$, what value(s) of x make $f(x)$ a relative (local) maximum?
- a. 3 b. -2, 2 c. -2, 3 d. -2 e. NOTA
24. A rectangle is inscribed in an ellipse with equation $4x^2 + 9y^2 = 36$. A formula which could be used to represent the area of any such rectangle is
- a. $A(x) = \frac{2}{3}x\sqrt{36-4x^2}$ b. $A(x) = \frac{x}{3}\sqrt{36-4x^2}$ c. $A(x) = \frac{8}{3}x\sqrt{9-x^2}$
d. $A(x) = \frac{4}{3}x\sqrt{9-x^2}$ e. NOTA
25. The acceleration of an object moving along a horizontal coordinate line is given by $a(t) = (2t+3)^{-3}$. If the velocity at $t = 0$ is $35/36$ and the initial position is 1 on the coordinate line, which of the following best describes the location of the point when $t = 2$?
- a. at $3/2$ b. left of 1 c. left of 2 d. right of 2 e. NOTA
26. Which of the following is a solution of the equation $\frac{dy}{dx} + \frac{x}{y} = 0$?
- a. $y = \sqrt{1-x}$ b. $y = 4 - x^2$ c. $y = \sqrt{4-x^2}$ d. $y = -2x$ e. NOTA
27. If $y = \cos^2 \frac{x}{2} - \sin^2 \frac{x}{2}$, then $y' =$
- a. 0 b. $\cos x$ c. $\sin x$ d. $-4 \sin \frac{x}{2} \cos \frac{x}{2}$ e. NOTA

28. If $f(x) = \frac{1}{2} (e^{\sin x})^2$, find $f'(5\pi/6)$.

- a. $\frac{-\sqrt{3}}{2} e$ b. $\frac{-\sqrt{3}e}{2}$ c. \sqrt{e} d. $\frac{-e\sqrt{3}}{2}$ e. NOTA

29. Evaluate $\frac{1}{\pi} \int_0^2 \frac{\tan^{-1}(x/2)}{x^2 + 4} dx$

- a. $2/\pi$ b. $\pi/32$ c. $1/\pi$ d. $\pi/64$ e. NOTA

30. The given figure shows the graph of f' , the derivative of f . Which of the following must be true?

- a. f' has an inflection at $x = 0$.
 b. f has a relative maximum at $x = 1$.
 c. f has an inflection at the origin.
 d. f has a relative minimum at $(0,0)$.
 e. NOTA

