



Multiple Choice Test # 3

- 11. (A) (B) (C) (D) (E)
- 12. (A) (B) (C) (D) (E)
- 13. (A) (B) (C) (D) (E)
- 14. (A) (B) (C) (D) (E)
- 15. (A) (B) (C) (D) (E)
- 16. (A) (B) (C) (D) (E)
- 17. ~~(A) (B) (C) (D) (E)~~
- 18. (A) (B) (C) (D) (E)
- 19. ~~(A) (B) (C) (D) (E)~~
- 20. (A) (B) (C) (D) (E)
- 21. ~~(A) (B) (C) (D) (E)~~
- 22. (A) (B) (C) (D) (E)
- 23. (A) (B) (C) (D) (E)

- 24. (A) (B) (C) (D) (E)
- 25. (A) (B) (C) (D) (E)
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- 28. (A) (B) (C) (D) (E)
- 29. (A) (B) (C) (D) (E)
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- 33. (A) (B) (C) (D) (E)
- 34. (A) (B) (C) (D) (E)
- 35. ~~(A) (B) (C) (D) (E)~~
- 36. ~~(A) (B) (C) (D) (E)~~
- 37. (A) (B) (C) (D) (E)
- 38. ~~(A) (B) (C) (D) (E)~~
- 39. (A) (B) (C) (D) (E)
- 40. ~~(A) (B) (C) (D) (E)~~
- 41. (A) (B) (C) (D) (E)
- 42. (A) (B) (C) (D) (E)
- 43. (A) (B) (C) (D) (E)
- 44. (A) (B) (C) (D) (E)
- 45. (A) (B) (C) (D) (E)

★ All work must be organized for credit.

Multiple Test #3

CALCULUS AB

① $\int_1^2 x^{-3} dx =$

(A) $-\frac{7}{8}$

(B) $-\frac{3}{4}$

(C) $\frac{15}{64}$

(D) $\frac{3}{8}$

(E) $\frac{15}{16}$

② If $f(x) = (2x + 1)^4$, then the 4th derivative of $f(x)$ at $x = 0$ is

(A) 0

(B) 24

(C) 48

(D) 240

(E) 384

③ If $y = \frac{3}{4 + x^2}$, then $\frac{dy}{dx} =$

(A) $\frac{-6x}{(4 + x^2)^2}$

(B) $\frac{3x}{(4 + x^2)^2}$

(C) $\frac{6x}{(4 + x^2)^2}$

(D) $\frac{-3}{(4 + x^2)^2}$

(E) $\frac{3}{2x}$

④ If $\frac{dy}{dx} = \cos(2x)$, then $y =$

(A) $-\frac{1}{2} \cos(2x) + C$

(B) $-\frac{1}{2} \cos^2(2x) + C$

(C) $\frac{1}{2} \sin(2x) + C$

(D) $\frac{1}{2} \sin^2(2x) + C$

(E) $-\frac{1}{2} \sin(2x) + C$

⑤ $\lim_{n \rightarrow \infty} \frac{4n^2}{n^2 + 10,000n}$ is

(A) 0

(B) $\frac{1}{2,500}$

(C) 1

(D) 4

(E) nonexistent

⑥ If $f(x) = x$, then $f'(5) =$

(A) 0

(B) $\frac{1}{5}$

(C) 1

(D) 5

(E) $\frac{25}{2}$

7) Which of the following is equal to $\ln 4$?

- (A) $\ln 3 + \ln 1$ (B) $\frac{\ln 8}{\ln 2}$ (C) $\int_1^4 e^t dt$ (D) $\int_1^4 \ln x dx$ (E) $\int_1^4 \frac{1}{t} dt$

8) The slope of the line tangent to the graph of $y = \ln\left(\frac{x}{2}\right)$ at $x = 4$ is

- (A) $\frac{1}{8}$ (B) $\frac{1}{4}$ (C) $\frac{1}{2}$ (D) 1 (E) 4

9) If $\int_{-1}^1 e^{-x^2} dx = k$, then $\int_{-1}^0 e^{-x^2} dx =$

- (A) $-2k$ (B) $-k$ (C) $-\frac{k}{2}$ (D) $\frac{k}{2}$ (E) $2k$

10) If $y = 10^{(x^2-1)}$, then $\frac{dy}{dx} =$

- (A) $(\ln 10) 10^{(x^2-1)}$ (B) $(2x) 10^{(x^2-1)}$ (C) $(x^2 - 1) 10^{(x^2-2)}$
(D) $2x(\ln 10) 10^{(x^2-1)}$ (E) $x^2(\ln 10) 10^{(x^2-1)}$

11) The position of a particle moving along a straight line at any time t is given by $s(t) = t^2 + 4t + 4$. What is the acceleration of the particle when $t = 4$?

- (A) 0 (B) 2 (C) 4 (D) 8 (E) 12

12) If $f(g(x)) = \ln(x^2 + 4)$, $f(x) = \ln(x^2)$, and $g(x) > 0$ for all real x , then $g(x) =$

- (A) $\frac{1}{\sqrt{x^2 + 4}}$ (B) $\frac{1}{x^2 + 4}$ (C) $\sqrt{x^2 + 4}$ (D) $x^2 + 4$ (E) $x + 2$

13) If $x^2 + xy + y^3 = 0$, then, in terms of x and y , $\frac{dy}{dx} =$

- (A) $-\frac{2x + y}{x + 3y^2}$ (B) $-\frac{x + 3y^2}{2x + y}$ (C) $\frac{-2x}{1 + 3y^2}$ (D) $\frac{-2x}{x + 3y^2}$ (E) $-\frac{2x + y}{x + 3y^2 - 1}$

14) The velocity of a particle moving on a line at time t is $v = 3t^{\frac{1}{2}} + 5t^{\frac{3}{2}}$ meters per second. How many meters did the particle travel from $t = 0$ to $t = 4$?

- (A) 32 (B) 40 (C) 64 (D) 80 (E) 184

15. The domain of the function defined by $f(x) = \ln(x^2 - 4)$ is the set of all real numbers x such that
 (A) $|x| < 2$ (B) $|x| \leq 2$ (C) $|x| > 2$ (D) $|x| \geq 2$ (E) x is a real number

16. The function defined by $f(x) = x^3 - 3x^2$ for all real numbers x has a relative maximum at $x =$
 (A) -2 (B) 0 (C) 1 (D) 2 (E) 4

~~17.~~ $\int_0^1 xe^{-x} dx =$

- (A) $1 - 2e$ (B) -1 (C) $1 - 2e^{-1}$ (D) 1 (E) $2e - 1$

18. If $y = \cos^2 x - \sin^2 x$, then $y' =$
 (A) -1 (B) 0 (C) $-2 \sin(2x)$ (D) $-2(\cos x + \sin x)$ (E) $2(\cos x - \sin x)$

- ~~19.~~ If $f(x_1) + f(x_2) = f(x_1 + x_2)$ for all real numbers x_1 and x_2 , which of the following could define f ?

- (A) $f(x) = x + 1$ (B) $f(x) = 2x$ (C) $f(x) = \frac{1}{x}$ (D) $f(x) = e^x$ (E) $f(x) = x^2$

20. If $y = \text{Arctan}(\cos x)$, then $\frac{dy}{dx} =$

- (A) $\frac{-\sin x}{1 + \cos^2 x}$ (B) $-(\text{Arcsec}(\cos x))^2 \sin x$ (C) $(\text{Arcsec}(\cos x))^2$
 (D) $\frac{1}{(\text{Arccos } x)^2 + 1}$ (E) $\frac{1}{1 + \cos^2 x}$

- ~~21.~~ If the domain of the function f given by $f(x) = \frac{1}{1 - x^2}$ is $\{x : |x| > 1\}$, what is the range of f ?

- (A) $\{x : -\infty < x < -1\}$ (B) $\{x : -\infty < x < 0\}$ (C) $\{x : -\infty < x < 1\}$
 (D) $\{x : -1 < x < \infty\}$ (E) $\{x : 0 < x < \infty\}$

22. $\int_1^2 \frac{x^2 - 1}{x + 1} dx =$

- (A) $\frac{1}{2}$ (B) 1 (C) 2 (D) $\frac{5}{2}$ (E) $\ln 3$

23) $\frac{d}{dx}\left(\frac{1}{x^3} - \frac{1}{x} + x^2\right)$ at $x = -1$ is

- (A) -6 (B) -4 (C) 0 (D) 2 (E) 6

24) If $\int_{-2}^2 (x^7 + k) dx = 16$, then $k =$

- (A) -12 (B) -4 (C) 0 (D) 4 (E) 12

25) If $f(x) = e^x$, which of the following is equal to $f'(e)$?

- (A) $\lim_{h \rightarrow 0} \frac{e^{x+h}}{h}$ (B) $\lim_{h \rightarrow 0} \frac{e^{x+h} - e^e}{h}$ (C) $\lim_{h \rightarrow 0} \frac{e^{e+h} - e}{h}$
(D) $\lim_{h \rightarrow 0} \frac{e^{x+h} - 1}{h}$ (E) $\lim_{h \rightarrow 0} \frac{e^{e+h} - e^e}{h}$

~~26)~~ The graph of $y^2 = x^2 + 9$ is symmetric with respect to which of the following?

- I. The x -axis
II. The y -axis
III. The origin

- (A) I only (B) II only (C) III only (D) I and II only (E) I, II, and III

27) $\int_0^3 |x-1| dx =$

- (A) 0 (B) $\frac{3}{2}$ (C) 2 (D) $\frac{5}{2}$ (E) 6

28) If the position of a particle on the x -axis at time t is $-5t^2$, then the average velocity of the particle for $0 \leq t \leq 3$ is

- (A) -45 (B) -30 (C) -15 (D) -10 (E) -5

29) Which of the following functions are continuous for all real numbers x ?

- I. $y = x^{\frac{2}{3}}$
II. $y = e^x$
III. $y = \tan x$

- (A) None (B) I only (C) II only (D) I and II (E) I and III

30. $\int \tan(2x) dx =$

(A) $-2 \ln |\cos(2x)| + C$

(B) $-\frac{1}{2} \ln |\cos(2x)| + C$

(C) $\frac{1}{2} \ln |\cos(2x)| + C$

(D) $2 \ln |\cos(2x)| + C$

(E) $\frac{1}{2} \sec(2x)\tan(2x) + C$

31. The volume of a cone of radius r and height h is given by $V = \frac{1}{3} \pi r^2 h$. If the radius and the height both increase at a constant rate of $\frac{1}{2}$ centimeter per second, at what rate, in cubic centimeters per second, is the volume increasing when the height is 9 centimeters and the radius is 6 centimeters?

(A) $\frac{1}{2} \pi$

(B) 10π

(C) 24π

(D) 54π

(E) 108π

32. $\int_0^{\frac{\pi}{3}} \sin(3x) dx =$

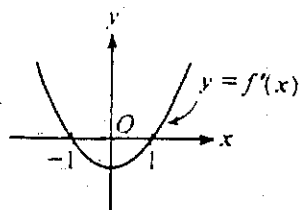
(A) -2

(B) $-\frac{2}{3}$

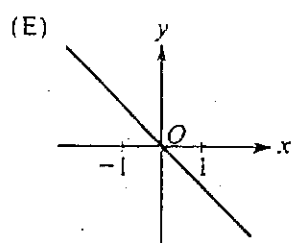
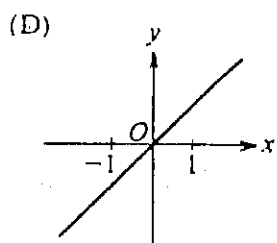
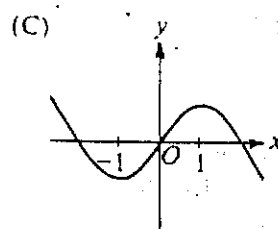
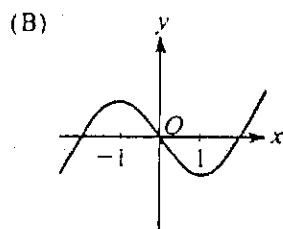
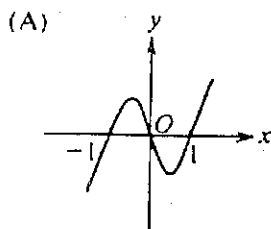
(C) 0

(D) $\frac{2}{3}$

(E) 2

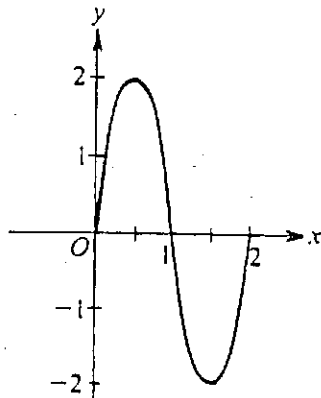


33. The graph of the derivative of f is shown in the figure above. Which of the following could be the graph of f ?



34) The area of the region in the first quadrant that is enclosed by the graphs of $y = x^3 + 8$ and $y = x + 8$ is

- (A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) $\frac{3}{4}$ (D) 1 (E) $\frac{65}{4}$



35) The figure above shows the graph of a sine function for one complete period. Which of the following is an equation for the graph?

- (A) $y = 2 \sin\left(\frac{\pi}{2}x\right)$ (B) $y = \sin(\pi x)$ (C) $y = 2 \sin(2x)$ (D) $y = 2 \sin(\pi x)$ (E) $y = \sin(2x)$

36) If f is a continuous function defined for all real numbers x and if the maximum value of $f(x)$ is 5 and the minimum value of $f(x)$ is -7 , then which of the following must be true?

- I. The maximum value of $f(|x|)$ is 5.
- II. The maximum value of $|f(x)|$ is 7.
- III. The minimum value of $f(|x|)$ is 0.

- (A) I only (B) II only (C) I and II only (D) II and III only (E) I, II, and III

37) $\lim_{x \rightarrow 0} (x \csc x)$ is

- (A) $-\infty$ (B) -1 (C) 0 (D) 1 (E) ∞

38) Let f and g have continuous first and second derivatives everywhere. If $f(x) \leq g(x)$ for all real x , which of the following must be true?

- I. $f'(x) \leq g'(x)$ for all real x
- II. $f''(x) \leq g''(x)$ for all real x
- III. $\int_0^1 f(x) dx \leq \int_0^1 g(x) dx$

- (A) None (B) I only (C) III only (D) I and II only (E) I, II, and III

39) If $f(x) = \frac{\ln x}{x}$ for $x > 0$, which of the following is true?

- (A) f is increasing for all x greater than 0.
- (B) f is increasing for all x greater than 1.
- (C) f is decreasing for all x between 0 and 1.
- (D) f is decreasing for all x between 1 and e .
- (E) f is decreasing for all x greater than e .

40) Let f be a continuous function on the closed interval $[0, 2]$. If $2 \leq f(x) \leq 4$, then the greatest possible value of $\int_0^2 f(x) dx$ is

- (A) 0 (B) 2 (C) 4 (D) 8 (E) 16

41) If $\lim_{x \rightarrow a} f(x) = L$, where L is a real number, which of the following must be true?

- (A) $f'(a)$ exists.
- (B) $f(x)$ is continuous at $x = a$.
- (C) $f(x)$ is defined at $x = a$.
- (D) $f(a) = L$
- (E) None of the above

42) $\frac{d}{dx} \int_2^x \sqrt{1+t^2} dt =$

- (A) $\frac{x}{\sqrt{1+x^2}}$ (B) $\sqrt{1+x^2} - 5$ (C) $\sqrt{1+x^2}$ (D) $\frac{x}{\sqrt{1+x^2}} - \frac{1}{\sqrt{5}}$ (E) $\frac{1}{2\sqrt{1+x^2}} - \frac{1}{2\sqrt{5}}$

43) An equation of the line tangent to $y = x^3 + 3x^2 + 2$ at its point of inflection is

- (A) $y = -6x - 6$ (B) $y = -3x + 1$ (C) $y = 2x + 10$ (D) $y = 3x - 1$ (E) $y = 4x + 1$

44) The average value of $f(x) = x^2\sqrt{x^3+1}$ on the closed interval $[0, 2]$ is

- (A) $\frac{26}{9}$ (B) $\frac{13}{3}$ (C) $\frac{26}{3}$ (D) 13 (E) 26

45) The region enclosed by the graph of $y = x^2$, the line $x = 2$, and the x -axis is revolved about the y -axis. The volume of the solid generated is

- (A) 8π (B) $\frac{32}{5}\pi$ (C) $\frac{16}{3}\pi$ (D) 4π (E) $\frac{8}{3}\pi$