1. The value of $\lim_{x\to 0}\frac{\sin(7x)}{x}$ is

a) 7 b) 0 c) 1 d) undefined e) none of these

2. If $f(x) = e^{\ln 5}$ then $f'(\pi) =$

a) $e^{\ln \pi}$ b) $e^{\ln(5+\pi)}$ c) $e\ln(5)$ d) 0 e) none of these

3. Let $\mathrm{f}(x) = 3-\sqrt{x}$. Then $\frac{f(x+h)-f(x)}{h}$ is equal to

a) $\frac{-h}{\sqrt{x}-\sqrt{x+h}}$ b) $\frac{-h}{2\sqrt{x}}$ c) $\frac{-1}{\sqrt{x}+\sqrt{x+h}}$ d) $\frac{-h}{\sqrt{x}+\sqrt{x+h}}$ e) none of these

4. The value of $\int_0^{\frac{\pi}{4}}\frac{\sin(x)}{\cos^3(x)}dx$ is

a) $\frac{\sqrt{2}}{2}$ b) 1 c) $\frac{1}{2}$ d) 2 e) none of these

5. Which value of x is where $f(x) = x^3 - 48x$ has a local maximum?

a) 4 b) -4 c) 48 d) $-\frac{48}{3}$ e) none of these

6. A particle is oscillating about the origin with its position given by the equation $y = 2\sin(\pi t)$ cm at t seconds. What is the velocity of the particle at $t = 5$ seconds in cm/s?

a) 2π b) 0 c) -2 d) -1 e) none of these

7. Find the value of

$$\lim_{x\to\frac{\pi}{2}}\left(\frac{\cos^2(3x)}{x-\frac{\pi}{2}}\right)$$

a) 6 b) 1 c) ∞ d) 0 e) none of these

8. If $f'(x) = e^{2x}$ and $f(0) = \frac{7}{2}$ then $f(x) =$

a) $e^{2x}+4$ b) $\frac{1}{2}e^{2x}+3$ c) $\frac{1}{2}e^{2x}+4$ d) $e^{2x}+3$ e) none of these

9. Find the equation(s) of the horizontal asymptotes of the function $f(x) = \frac{4-|x|}{2x}$

a) $y = 2$ only b) $y = \frac{1}{2}$ only c) $y = -\frac{1}{2}$ only

d) $y = \frac{1}{2}$ and $y = -\frac{1}{2}$ e) none of these

10. The function $f(x) = \frac{3x}{x^2+1}$ is not continuous at $x =$

a) 0 b) 1 c) -1 d) ± 1 e) none of these

11. Let $f(x) = x^4 - x^3$. Find the difference between the slope of the secant line joining $(1, f(1))$ to $(2, f(2))$ and the slope of the tangent line at $(2, f(2))$.

a) 12 b) 36 c) 8 d) 16 e) none of these

12. If $f(x) = \begin{cases} -1 & if\ x\ is\ rational \\ 1 & if\ x\ is\ irrational \end{cases}$ then $\lim_{x \to \pi} f(x)$ is

a) -1 b) undefined c) 1 d) π e) none of these

13. Using the table below, find the difference between approximating $\int_0^{16} f(x)dx$ using the rectangular method with right endpoints and the rectangular method with left endpoints. (Four rectangles in each approximation.)

x	0	4	8	12	16
$f(x)$	1	3	4	6	4

a) 12 b) 4 c) 10 d) 8 e) none of these

14. The derivative of $\cos^{-1}\left(\frac{x}{2}\right)$ is

a) $\frac{2}{\sqrt{4-x^2}}$ b) $\frac{-1}{\sqrt{16-4x^2}}$ c) $-\frac{2}{\sqrt{4-x^2}}$ d) $\frac{1}{x^2+4}$ e) none of these

15. If $f'(x) = \begin{cases} x+1 & x \leq 2 \\ -x^2+7 & x > 2 \end{cases}$ which of the following are true?

i) f is continuous at $x = 2$ ii) f is differentiable at $x = 2$ iii) f is increasing at $x = 2$

a) i only b) iii only c) i, ii, and iii d) i and iii only e) none of these

16. The value of $\int_0^2 x\sqrt{4-x^2}\,dx$ is:

a) $\frac{1}{4}$ b) $\frac{2\sqrt{2}}{3}$ c) $\frac{8}{3}$ d) $\frac{1}{2}$ e) none of these

17. The function $f(x) = \frac{x^3-9x}{x^2-x-6}$ has a removable discontinuity at $x =$

a) -2 b) 3 c) -2 and 3 d) 2 and -3 e) none of these

18. The graph of $f(x) = (x^2-4)^{\frac{2}{3}}$ has a cusp at

a) 1 b) 0 c) -2 d) 4 e) none of these

19. If $(x) = \sqrt{x+1}$, $x = 3$, and $dx = 0.1$ then find dy.

a) 0.5 b) 0.25 c) 2 d) 0.025 e) none of these

20. Let $f(x) = x^3 - 6x^2 + 9x + 5$ on the interval [0,4]. The sum of the y-values that would be checked for possible maximums/minimums (using the Extreme Value Theorem) is:

a) 18 b) 29 c) 23 d) 10 e) none of these

21. Find the region(s) where the function is concave down. $f(x) = 2x^4 - 12x^3$

a) $\left(0, \frac{9}{2}\right)$ b) $(-\infty, 0) \cup \left(\frac{9}{2}, \infty\right)$ c) $(-3,0)$

d) $(-\infty, 0)$ e) none of these

22. Estimate the area under the curve $y = \frac{1}{2}x^2$ between $x = 0$ and $x = 4$ by using 4 equal subintervals and the Trapezoid Method. $Area \approx$

a) 44 b) 60 c) 176 d) 240 e) none of these

23. The area between $y = \sin(2x) + 1$ and the x-axis on the interval $[\frac{\pi}{2}, 2\pi]$ is:

a) $\frac{3\pi - 1}{2}$ b) $\frac{3\pi + 2}{2}$ c) 3π d) $\frac{3\pi}{2}$ e) none of these

24. If $f(x) = \begin{cases} x+3 & x<1 \\ \sin(x)+1 & -1 \le x < 0 \\ \sqrt{x+1} & 0 \le x < 3 \\ 2 & 3 \le x \end{cases}$ then a false statement would be:

a) f(x) is continuous at x=3 b) f(x) is continuous from the right at x=0

c) f(x) is continuous at x=5 d) f(x) is continuous from the right at x=-1 e) none of these

25. If $f(x) = \begin{cases} 2x & x \ge 0 \\ -x & x < 0 \end{cases}$ then $\lim_{x\to 0^+} f'(x) - \lim_{x \to 0^-} f'(x) =$

a) 0 b) 1 c) 2 d) 3 e) none of these

26. Using the function $f(x) = \tan(x)$ on the interval $[0, \pi]$ find the value of $x = c$ that is guaranteed by Rolle's Thm.

a) $\frac{\pi}{2}$ b) 0 c) π d) $\frac{3\pi}{4}$ e) none of these

27. The function $f(x) = x^3 - 4x^2 + 2x - 3$ has inflection point(s) at:

a) $x = -\frac{1}{3}$ b) $x = 3$ c) $x = \frac{4}{3}$ d) $x = -\frac{1}{3}, x = 3$ e) none of these

28. Farmer Bob wants to pen in a rectangular plot using 120 feet of fencing. He also wants to subdivide the plot into two smaller rectangles of equal area using a parallel partition of that same fencing. What is the sum of the dimensions of the full plot that maximize the area? (All answer below in feet.)

a) 60 b) 40 c) 80 d) 50 e) none of these

29. If $f(x) = \int_1^{x^2} e^{2t}\,dt$ then $f'(x) =$

a) e^{2x^2} b) $2e^{2x^2}$ c) $2xe^{2x^2}$ d) e^{2x} e) none of these

30. A rectangle is inscribed in the top half of the ellipse $2x^2 + y^2 = 1$ using part of the x-axis as a base of the rectangle. What is the largest area that rectangle can have?

a) $\frac{\sqrt{2}}{2}$ b) $\frac{1}{2}$ c) 1 d) $\frac{1}{4}$ e) none of these

31. The integral that represents the area between $f(x) = -2x^2 + 9x - 8$ and $g(x) = x^2 - 3x + 1$ is:

a) $\int_1^3 (3x^2 - 12x + 9)dx$ b) $\int_1^3 (-3x^2 + 12x - 9)dx$

c) $\int_3^1 (3x^2 + 12x + 9)dx$ d) $\int_3^1 (-3x^2 - 12x + 9)dx$ e) none of these

32. Find the x_2 approximation to a root of $f(x) = x^4 + 16$ using Newton's Method with initial guess $x_0 = 2$.

a) $\frac{26}{2}$ b) $\frac{13}{17}$ c) $-\frac{13}{4}$ d) $\frac{421}{108}$ e) none of these

33. A value of c that satisfies the Mean Value Theorem for $f(x) = \sqrt{x-3}$ on $[3, 12]$ is:

a) $\frac{1}{3}$ b) $\frac{21}{4}$ c) $\frac{9}{2}$ d) does not exist e) none of these

34. The position of a particle is given by the function $s(t) = 2t^3 - 10t^2 + 4t - 8$ for $t \geq 0$. At what time does the particle have no acceleration?

a) 0 and $\frac{10}{3}$ b) 0 c) $\frac{5}{3}$ d) $\frac{10}{3}$ e) none of these

35. Find the derivative of $y^2 + x\sin(y) = 3$

a) $y' = \frac{\cos(y)}{2y + x\cos(y)}$ b) $y' = \frac{\sin(y)}{-x\cos(y) + 2y}$ c) $y' = \frac{-x\cos(y)}{2y}$

d) $y' = -\frac{\sin(y)}{2y + x\cos(y)}$ e) none of these

36. If $\frac{\partial z}{\partial x}$ is the derivative of z with respect to x treating y as a constant, find $\frac{\partial z}{\partial x}$ of $z = 9x^2 + 3xy + 2y + 1$.

a) 18x+3y b) 18x+5 c) 18x+3 d) 9x+2 e) none of these

37. Finding the volume of the solid obtained by rotating the bounded region $y = \sqrt{x}$, $x = 0$, $y = 4$ around the y-axis would require solving which one of the following integrals?

a) $\pi\int_0^2 y^4\,dy$ b) $\pi\int_0^4 y^4\,dy$ c) $\pi\int_0^2 x\,dx$ d) $\pi\int_0^{16} x\,dx$ e) none of these

38. If $\int_3^1 f(x)dx = -3$ $\int_1^{10} f(x)dx = 7$ $\int_3^4 g(x)dx = -1$ $\int_4^{10} g(x)\,dx = 5$

then the value of $\int_3^{10}[2f(x) - g(x)]dx$ is:

a) 16 b) 4 c) -2 d) 2 e) none of these

39. Given that $\int u\,e^{au}\,du = \left(\frac{u}{a} - \frac{1}{a^2}\right)e^{au} + C$ then $\int x^3 e^{3x^2}\,dx =$

a) $\left(\frac{x^2}{6} - \frac{1}{9}\right)e^{3x^2} + C$ b) $\left(\frac{x^2}{3} - \frac{1}{9}\right)e^{3x^2} + C$ c) $\left(\frac{x^3}{3} - \frac{x}{9}\right)e^{3x^2} + C$

d) $\left(\frac{x^2}{3} + \frac{1}{18}\right)e^{3x^2} + C$ e) none of these

40. The average value of $g(x) = x^3 - 4x$ on $[-1, 2]$ is:

a) $-\frac{9}{16}$ b) $\frac{5}{8}$ c) $-\frac{9}{4}$ d) $\frac{9}{8}$ e) none of these