Where applicable, "E. NOTA" indicates that none of the above answers is correct.

1. Evaluate: $\lim\limits_{x \to 2} \dfrac{3x^2 + 2x - 7 + 3x^3}{x^3 - 4x^2 - 11x + 2}$

A. 0   B. 3   C. $-\dfrac{33}{28}$ D. ¥   E. NOTA

2. Given that $f(x) = x^2 + 2$ and $y = g(x)$ is the equation of the tangent line to $y = f(x)$ at $x = 1$, find the positive difference between the x- and y-intercepts of $y = g(x)$.

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

3. Solve $\displaystyle\int \dfrac{x^2 + 4x + 3}{(2x + 1)(x^2 + 1)} dx$

A. $\dfrac{1}{2}\ln|2x + 1| + 2\tan^{-1}(x) + c$ B. $\ln|2x + 1| + 2\tan^{-1}(x) + c$ C. $2\tan^{-1}(\ln|2x + 1|) + c$

D. $\dfrac{1}{2}\tan^{-1}(\ln|2x + 1|) + c$ E. NOTA

4. Solve $\displaystyle\int_{-2}^{3} \left|x^2 + x - 2\right| dx$

A. $\dfrac{25}{6}$ B. $\dfrac{65}{6}$ C. $\dfrac{79}{6}$ D. $\dfrac{9}{2}$ E. NOTA

5. Given that $f(x) = (x + |x|)^2 + 1$, find the equation of the normal line to $f(x)$ through the point where $x = \dfrac{1}{2}$.

A. $y = -\dfrac{1}{4}x + \dfrac{17}{8}$ B. $y = 4x - 2$ C. $y = 4x$ D. $y = 2x + 1$ E. NOTA

6. Which is the greatest of the minimum values, absolute or relative, of $f(x) = x^3 - 9x^2 - 48x + 52$ on the closed interval $[-5, 12]$?

A. 104   B. -58   C. -396   D. -92   E. NOTA

7. Approximate $\sqrt[3]{10}$ using one iteration of Newton's Method and function $f(x) = x^3 - 10$ with $x_0 = \dfrac{5}{2}$.

A. 2.154   B. 2.155   C. 2.150   D. 2.152   E. NOTA

8. Calculate $\displaystyle\sum_{n=2}^{\infty} \left(\dfrac{n}{n-1}\right)^{-n}$

A. diverges   B. 0   C. e^{-1} D. $-e$ E. NOTA

9. Solve for the digit **B** in the following equation: $3B_6 + 10_7 = 20_{1B}$

A. 4   B. 5   C. 6   D. 7   E. NOTA

10. Evaluate $\displaystyle\lim_{x\to 1}\frac{4^x - 2\cdot 2^x}{x^2 - 1}$

A. $\yen$ B. $-\yen$ C. $\ln 2$ D. $\ln 4$ E. NOTA

11. Find the sum of the entries of $\begin{bmatrix} 2 & 0 \\ 1 & 6 \end{bmatrix}^{-1}$.

A. $\dfrac{7}{11}$ B. $\dfrac{7}{12}$ C. $\dfrac{1}{13}$ D. $\dfrac{1}{2}$ E. NOTA

12. $5\sqrt{6 + 5\sqrt{6 + 5\sqrt{6 + \dots}}} =$

A. $5 + \sqrt{6}$ B. $\sqrt{6}e^{\ln 5}$ C. 27   D. 30   E. NOTA

13. Billy-Bob is pouring gasoline into a cylindrical tank of radius 2 feet. When the depth of the gasoline is 3 feet, the depth is increasing at 0.4 ft/sec. How fast is the volume of the gasoline changing at that instant?

A. $1.6\rho\,ft^3/\sec$ B. $4.8\rho\,ft^3/\sec$ C. $4\rho\,ft^3/\sec$ D. $12\rho\,ft^3/\sec$ E. NOTA

14. Evaluate $\tan\left(i\ln\left(\dfrac{1}{\sqrt{i}}\right)\right)$

A. 0   B. 1   C. ρ D. Undefined   E. NOTA

15. Find the total area enclosed by the petals of $r = 2\cos(3q)$.

A. $\dfrac{\rho}{6}$ B. ρ C. $\dfrac{\rho}{3}$ D. $\dfrac{\rho}{2}$ E. NOTA

16. From time $\theta = 0$ to $\theta = \pi$ a bug follows a path given by the parametric equations $x = 2\cos^2 q$ and $y = \sin 2q$. What is the length of the path traveled by this bug?

A. $\dfrac{\rho}{2}$ B. $\dfrac{\rho}{4}$ C. ρ D. 2ρ E. NOTA

17. Given that $\sin(xy) = x + y$, find $\dfrac{dy}{dx}$.

A. $\dfrac{1 + y\sin(xy)}{1 + x\sin(xy)}$ B. $\dfrac{1 - y\cos(xy)}{1 - x\cos(xy)}$ C. $-\dfrac{1 - y\cos(xy)}{1 - x\cos(xy)}$ D. $\dfrac{1}{\cos(xy) - 1}$ E. NOTA

18. Given the differential equation $y' = x + 5y$ and initial conditions $y(0) = -\dfrac{1}{25}$, find $y\left(\dfrac{1}{50}\right)$.

A. 10   B. $-\dfrac{1}{25}$ C. $\dfrac{2}{25}$ D. -10 E. NOTA

19. Given $f(x) = e^{\sin(x)}$, use the second degree Taylor polynomial for $f(x)$ about $x = 0$ to approximate $f(4)$.

A. $\sin(4) + 1$ B. $e^{\sin(4)}$ C. 13   D. $e^{\cos(4)}$ E. NOTA

20. Calculate $\displaystyle\lim_{n \to \infty} \sum_{i=1}^{n} \frac{i - 1 + 2n}{in - n + n^2}$

A. $\tan^{-1}(2)$ B. 1   C. diverges   D. $1 + \ln 2$ E. NOTA

21. Find the area of the region bounded by $x = \sin y$ and $x = \cos y$ on the interval $0 \le y \le \dfrac{\pi}{2}$.

A. π B. 0   C. $\sqrt{2} - 1$ D. $2 - 2\sqrt{2}$ E. NOTA

22. A rock is thrown vertically upwards from the surface of the former planet Pluto with an initial velocity of 12.6 meters per second. The rock finally hit the surface after a minute. Assuming Pluto has a constant acceleration due to gravity, what was the rock's maximum height above the surface Pluto?

A. 567 meters   B. 189 meters   C. 283.5 meters   D. 94.5 meters   E. NOTA

23. What is the eccentricity of the conic described by the polar equation
$r = \dfrac{20}{\sqrt{16\cos^2 \theta + 25\sin^2 \theta}}$?

A. $\dfrac{3}{5}$ B. $\dfrac{2\sqrt{5}}{4}$ C. $\dfrac{2\sqrt{5}}{5}$ D. $\dfrac{\sqrt{5}}{2}$ E. NOTA

24. A cup of $100°C$ liquid is left in a $20°C$ room and sits for x minutes until it has cooled to $60°C$. Then it is taken outside where the temperature is $-4°C$. After spending 15 minutes outside the liquid is now $-2°C$. Solve for x, the number of minutes the liquid spent inside.

A. 3   B. 4   C. $\dfrac{15\ln\left(\dfrac{30}{50}\right)}{-\ln 30}$ D. 15   E. NOTA

25. Solve $\displaystyle\int_{0}^{2} e^x x^4 \, dx$

A. $104e^2$ B. $64e^2$ C. $8e^2$ D. $8e^2 - 24$ E. NOTA

26. What is the positive difference between the upper and lower Riemann sums with n uniform subdivisions used to approximate the integral $\int_1^2 \frac{1}{x}\,dx$?

A. 1

B. $\frac{1}{2n}$

C. $\frac{1}{1-\frac{1}{n}}$

D. $2-\frac{1}{n}$

E. NOTA

27. What is the volume of the figure created by revolving the region bounded by the functions $y = x^2$ and $y = 2x^2 - 1$ about the y-axis?

A. $\frac{\rho}{2}$

B. ρ

C. 2ρ

D. $\frac{\rho}{4}$

E. NOTA

28. Find the sum of the series $\sum_{n=2}^{\yen} \frac{(n-1)e^n}{n!}$

A. 1

B. $\yen$

C. $e^e - 1$

D. $e^e(e-1)+1$

E. NOTA

29. What is the coefficient of the x^7 term in the expansion of $\frac{d}{dx}\left(\frac{x^2}{4} - 2\right)^{10}$?

A. -420

B. -1200

C. 210

D. 840

E. NOTA

30. Find $\frac{d}{dx}\left(\int_{\tan x}^{\pi} \sqrt{1+t^2}\,dt\right)$ for $0 < x < \frac{\pi}{2}$.

A. $\sqrt{1+\rho^2} - \sec^2 x$

B. $-\sec x$

C. $\sec x$

D. $-\sec^3 x$

E. NOTA