The abbreviation NOTA denotes "None of these answers."

1. Given $f(t)=\sqrt[3]{t}$, $g(t)=\cos t$, $h(t)=(fg)(t)$, and $0\le t\le \pi$ find $h(\pi)$.

A) $\cos(-1)$ ***B)*** -1 ***C)*** $\cos\sqrt[3]{\pi}$ ***D)*** $-\sqrt[3]{\pi}$ ***E)*** NOTA

2. Solve $\dfrac{x+3}{x}-\dfrac{2}{x+3}=\dfrac{6}{x^2+3x}$ over the reals.

A) $\{-3\}$ ***B)*** $\{-3,-1\}$ ***C)*** $\{-1\}$ ***D)*** $\{1,3\}$ ***E)*** NOTA

3. What is the *y*-intercept of the graph of $f(x)=b^x$ for real numbers *b* and *x*, for positive constant *b*?

A) 0 ***B)*** 1 ***C)*** b ***D)*** $|x|$ ***E)*** NOTA

4. Suppose $f(x)=Q+R\ln x$ where *Q* and *R* are real constants. If $f(1)=5$ and $f(e)=4$, find $\dfrac{Q}{R}$.

A) -5 ***B)*** $\dfrac{1}{5}$ ***C)*** 4 ***D)*** $\dfrac{1}{4}$ ***E)*** NOTA

5. Let (*a, b*) and (*c, d*) represent the endpoints of the latus rectum of $x^2-6x-4y+17=0$. Find the sum of the ordinates of these endpoints.

A) -4 ***B)*** -2 ***C)*** 4 ***D)*** 6 ***E)*** NOTA

6. Solve the inequality $\dfrac{2}{x+3}\le\dfrac{1}{x-1}$ $\{x:x\in\square\}$

A) $(-\infty,-3)\cup(1,5]$ ***B)*** $(-\infty,5]$ ***C)*** $[5,\infty)$ ***D)*** $(-3,1)\cup[5,\infty)$ ***E)*** NOTA

7. In right triangle *ABC* with right angle *B*, angle *C* = 39° and side *a* = 23, find side *b* to the nearest tenth.

A) 14.5 ***B)*** 17.9 ***C)*** 28.4 ***D)*** 36.5 ***E)*** NOTA

8. What is the period of the function $f(t)=\sin^2 t-\cos^2 t$.

A) $\dfrac{\pi}{2}$ ***B)*** 2 ***C)*** π ***D)*** 2π ***E)*** NOTA

9. Find an equation in terms of x and y whose graph includes the graph of: $x = t^2,\ y = 2t + 1$ for any t.

A) $4x = (y-1)^2$ ***B)*** $4x = (y+1)^2$ ***C)*** $4y = (x-1)^2$ ***D)*** $4y = (x+1)^2$ ***E)*** NOTA

10. 24 students are on tour of the United Nations Building. 12 students speak Russian, 6 speak German, and 15 speak Spanish. Only one student speaks all three languages. 2 students speak Russian and German, but not Spanish. One student does not speak Russian or Spanish and 6 do not speak Spanish or German. All 24 students speak at least one of the three languages. How many students speak both Russian and Spanish, but not German?

A) 2 ***B)*** 3 ***C)*** 6 ***D)*** 9 ***E)*** NOTA

11. Find the inverse of the coefficient matrix for the system of equations: $\begin{matrix} x+2y=6 \\ 3x+4y=12 \end{matrix}$.

A) $\begin{bmatrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{bmatrix}$ ***B)*** $\begin{bmatrix} -\frac{1}{2} & -\frac{3}{2} \\ -1 & -\frac{1}{2} \end{bmatrix}$ ***C)*** $\begin{bmatrix} 1 & -\frac{3}{2} \\ -1 & 2 \end{bmatrix}$ ***D)*** $\begin{bmatrix} -2 & 1 \\ -\frac{3}{2} & \frac{1}{2} \end{bmatrix}$ ***E)*** NOTA

12. Which of the following is equivalent to the expression $\log_f (g+h)$, where f, g, and h are all real numbers greater than 1?

A) $f \ln(h+g)$ ***B)*** $f \ln h \ln g$ ***C)*** $\ln \frac{h+g}{f}$ ***D)*** $\frac{\ln(h+g)}{\ln f}$ ***E)*** NOTA

13. Solve for x: $y = 1 + \dfrac{1}{1+\frac{1}{x}}$

A) $x = 1 - \frac{1}{y}$ ***B)*** $x = \frac{y-1}{y}$ ***C)*** $x = \frac{1-y}{y-2}$ ***D)*** $x = \frac{y+1}{2+y}$ ***E)*** NOTA

14. Find the perimeter (to the nearest tenth) of a 45° slice of large circular cheese pizza if the slice is a sector and the pizza has a 14-inch-diameter.

A) 14.1" ***B)*** 19.5" ***C)*** 20.3" ***D)*** 36.0" ***E)*** NOTA

15. The expression $\frac{5x^2+7x-4}{x^3+4x^2}$ is equal to $\frac{A}{x} + \frac{B}{x^2} + \frac{C}{x+4}$. Find C.

A) -1 ***B)*** 1 ***C)*** 2 ***D)*** 3 ***E)*** NOTA

16. How many real numbers between 0 and 2π solve the equation $4\cos^2 x - 3 = -\cos x$?

A) 0 ***B)*** 1 ***C)*** 2 ***D)*** 3 ***E)*** NOTA

17. Find all horizontal and vertical asymptotes of $f(x)=\dfrac{2x-4}{x^2-4}$.

A) $x=0,\ x=2,\ y=-2$ ***B)*** $x=-2,\ x=2,\ y=0$
C) $x=-2,\ y=0$ ***D)*** $x=0,\ y=2$ ***E)*** NOTA

18. Which ordered pair is **not** in the *inverse* of the relation given by $x^2y+y^2=10$?

A) $\left(1,\sqrt{3}\right)$ ***B)*** $\left(2,-\sqrt{3}\right)$ ***C)*** $(1,-3)$ ***D)*** $\left(2,\sqrt{3}\right)$ ***E)*** NOTA

19. Given $\sin\theta=0.4$ and $\cot\theta>0$, find $\sin(-\theta)+\tan(-\theta)+\csc(\theta)$ to the nearest hundredth.

A) −3.29 ***B)*** −1.76 ***C)*** 1.66 ***D)*** 2.51 ***E)*** NOTA

20. Find twice the product of all the real zeros of the function $g(x)=x^3+3x^2-16x-48$.

A) −64 ***B)*** −24 ***C)*** 48 ***D)*** 96 ***E)*** NOTA

21. How many positive real x-coordinates of the solutions exist for the system of equations: $\begin{aligned} y&=2e^{2x}-3\\ e^x&=-\frac{1}{5}y\end{aligned}$?

A) 0 ***B)*** 1 ***C)*** 2 ***D)*** 3 ***E)*** NOTA

22. If $2x^2(x-4)^{-\frac{1}{2}}+\dfrac{x}{2}(x-4)^{\frac{1}{2}}$ is rewritten in the form $\dfrac{Ax^2-4x}{2\sqrt{x-4}}$, find the value of A.

A) −15 ***B)*** −4 ***C)*** 2 ***D)*** 5 ***E)*** NOTA

23. For oblique triangle DEF where E is an obtuse angle, $\sin(D+E)$ is equal to:

A) $\sin(D+F)$ ***B)*** $\sin(E)$ ***C)*** $\sin(E+F)$ ***D)*** $\sin(F)$ ***E)*** NOTA

24. What is the domain of the function $f(x)=\dfrac{\sqrt{4-x^2}}{x+4}$?

A) $[-2,2]$ ***B)*** $(-2,2)$ ***C)*** $(-\infty,-2)\cup(2,\infty)$ ***D)*** $[0,2]$ ***E)*** NOTA

25. Which is an equation of a sinusoid that passes through the point $(2,0)$, has period $\frac{\pi}{3}$ and amplitude 3?

A) $y = 3\sin(6x-2)$ ***B)*** $y = 3\sin(6x-12)$ ***C)*** $y = 6\sin\left(\frac{2}{3}\pi x - \frac{4}{3}\right)$ ***D)*** $y = 6\sin\left(\frac{2}{3}x - \frac{2}{3}\right)$ ***E)*** NOTA

26. The population of Las Vegas , Nevada in January 2000 was 478,000 and has been increasing at the rate of 6.28% each year. At that rate, in what year will the population be 1 million?

A) 2002 ***B)*** 2007 ***C)*** 2012 ***D)*** 2034 ***E)*** NOTA

27. For triangle *JKL* with angle $K = 57°$, side $j = 11$ and side $k = 10$, find all possible measures for angle *J*, to the nearest tenth.

A) no triangle possible ***B)*** 92.3° ***C)*** 124.3° and 55.7° ***D)*** 112.7° and 67.3° ***E)*** NOTA

28. State the range of $h(\theta) = \tan\theta\cos\theta$.

A) $(-\infty,\infty)$ ***B)*** $[-\pi,\pi]$ ***C)*** $\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ ***D)*** $(-1,1)$ ***E)*** NOTA

29. If the area of a triangle with sides 7, 8, and 9 equals $a\sqrt{b}$ in simplified radical form, find *ab*.

A) 30 ***B)*** 60 ***C)*** 84 ***D)*** 504 ***E)*** NOTA

30. Find the acute angle θ that satisfies $\cot\theta = \frac{4}{\sqrt{48}}$

A) $\frac{\pi}{3}$ ***B)*** $\frac{\pi}{4}$ ***C)*** $\frac{\pi}{5}$ ***D)*** $\frac{\pi}{6}$ ***E)*** NOTA