For all questions, answer E. NOTA means none of the above answers is correct.

1. Determine which function is neither even nor odd.

   A. $f(x) = \tan x$ B. $f(x) = 3x^5 + 5x^3 + 1$ C. $f(x) = \dfrac{3}{x^2}$

   D. $f(x) = \sqrt{x^2 + 1}$ E. NOTA

2. Find a value of x so that the distance between the points $(6, -1)$ and $(x, 9)$ is 12.

   A. $2\sqrt{31}$ B. $6 + 2\sqrt{11}$ C. $6 + 4\sqrt{10}$ D. $-6 + 4\sqrt{5}$ E. NOTA

3. How many times will the graphs of $f(x) = 2^x - 3$ and $g(x) = \log x$ intersect?

   A. 0 B. 1 C. 2 D. 3 E. NOTA

4. Determine the value of c so that $f(x)$ is continuous over all reals when $f(x) = \begin{cases} x + 3, & x \le -1 \\ 2x - c, & x > -1 \end{cases}$.

   A. –4 B. –1 C. 0 D. 4 E. NOTA

5. If each point of the circle $x^2 + y^2 = 25$ is reflected in the point (4, 1), the set of image points satisfies the equation $x^2 + ay^2 + bx + cy + d = 0$. Find $a + b + c + d$.

   A. 64 B. 24 C. –22 D. –17 E. NOTA

6. The polar coordinates of the point with rectangular coordinates $\left(2\sqrt{3}, -2\right)$ are:

   A. $\left(4, \dfrac{5\pi}{3}\right)$ B. $\left(-4, \dfrac{5\pi}{6}\right)$ C. $\left(-4, \dfrac{11\pi}{6}\right)$ D. $\left(4, \dfrac{7\pi}{6}\right)$ E. NOTA

7. If (a, b) is the intersection of the graphs of $y = 2^x$ and $y = 2^{2x} - 12$, find the value of $a + b$, given that the domain is all real numbers.

   A. 0 B. 2 C. 4 D. 8 E. NOTA

8. When the graph of $y = f(x)$ is reflected over the x-axis and then moved to the right 7 units, the equation of the new graph is:

   A. $y = -f(x) - 7$ B. $y = -f(x + 7)$ C. $y = -f(x - 7)$

   D. $y = f(-(x + 7))$ E. NOTA

9. The graph of $y=\sqrt{x+9}-5$ has *x*-intercept at $x=a$ and *y*-intercept at $y=b$. Find the product *ab*.

A. –32 B. –27 C. 24 D. 27 E. NOTA

10. The graph of $y=f(x)$ is a straight line segment joining the points $(-2,3)$ and (4, 5). What is the slope of the graph of $y=f^{-1}(x)$?

A. –3 B. $-\frac{1}{3}$ C. $\frac{1}{3}$ D. 3 E. NOTA

11. Find the equation of the top half of the ellipse $\frac{(x+2)^2}{4}+\frac{(y-3)^2}{9}=1$.

A. $y=3+\frac{3}{2}\sqrt{-4x-x^2}$ B. $x=-2+\frac{2}{3}\sqrt{6y-y^2}$ C. $y=3-\frac{3}{2}\sqrt{-4x-x^2}$

D. $y=3+\frac{3}{2}\sqrt{x^2+4x}$ E. NOTA

12. Find the equations of the asymptotes for the hyperbola $\frac{(x-1)^2}{2}-\frac{(y+2)^2}{4}=1$.

A. $y+2=\pm\frac{\sqrt{2}}{2}(x-1)$ B. $y-2=\pm\sqrt{2}(x+1)$ C. $y+2=\pm\sqrt{2}(x-1)$

D. $y=\pm x\sqrt{2}$ E. NOTA

13. If the system $\begin{cases}x+3y=2\\2x+\left(a^2+2\right)y=a+2\end{cases}$ has no solution, then $a=c$. If it has infinitely many solutions, then $a=d$. Find $c+d$.

A. –4 B. –2 C. 0 D. 4 E. NOTA

14. If the graphs of $\frac{4}{x}+\frac{7}{y}=10$ and $\frac{2}{x}-\frac{6}{y}=6$ intersect at (*a*, *b*), find $a+b$.

A. $-\frac{931}{102}$ B. $-\frac{16}{17}$ C. $\frac{272}{105}$ D. $\frac{49}{19}$ E. NOTA

15. The equation of the line that is tangent to the circle $x^2+y^2=25$ at the point $(-4, 3)$ is:

A. $4x-3y=25$ B. $3x-4y=-25$ C. $3x+4y=25$

D. $4x+3y=25$ E. NOTA

16. A line through the point (–*a*, 0) cuts from the Quadrant II a triangular region with area *T*. The equation of this line is:

A. $2Tx + a^2y + 2aT = 0$ B. $2Tx + a^2y - 2aT = 0$ C. $2Tx - a^2y - 2aT = 0$
D. $2Tx - a^2y + 2aT = 0$ E. NOTA

17. If the parabola $y = Px^2 + Qx + 5$ passes through (1, 1) and (–1, 7), find $P + Q$.

A. –4 B. –2 C. 0 D. 6 E. NOTA

18. Find the volume of the parallelepiped constructed by the vectors $\langle 3,2,1\rangle$, $\langle -1, 3, 0\rangle$, and $\langle 2,2,5\rangle$.

A. 39 B. 45 C. 47 D. 51 E. NOTA

19. The graph of $f(x) = \dfrac{x^3 + 7x^2 + 16x + 12}{x^2 + 6x + 8}$ has:

A. a hole B. a horizontal asymptote C. two vertical asymptotes
D. all of these E. NOTA

20. Find the coordinates of the point located $\frac{5}{6}$ of the distance from (4, 18) to (12, –6).

A. $\left(\dfrac{16}{3}, 14\right)$ B. $(10, -4)$ C. $\left(\dfrac{32}{3}, -2\right)$ D. $\left(\dfrac{30}{3}, -\dfrac{7}{3}\right)$ E. NOTA

21. The range of the function $f(x) = \text{Sin}^{-1}x$ is:

A. $\left(-\dfrac{\pi}{2}, 0\right) \cup \left(0, \dfrac{\pi}{2}\right)$ B. $\left(-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right)$ C. $\left[-\dfrac{\pi}{2}, 0\right) \cup \left(0, \dfrac{\pi}{2}\right]$
D. $\left[-\dfrac{\pi}{2}, \dfrac{\pi}{2}\right]$ E. NOTA

22. The distance between the points of intersection of $x^2 + y = 10$ and $x + y = 10$ is:

A. less than 1 B. 1 C. 1.5 D. 2 E. NOTA

23. The equations of the angle bisectors for the angles formed by $3x-4y+2=0$ and $5x+12y-3=0$ are:

A. $64x+18y+11=0,\ 14x-102y+41=0$ B. $14x-112y+41=0,\ 64x+8y+11=0$
C. $14x-112y+41=0,\ 64x+18y+11=0$ D. $64x+8y+11=0,\ 14x-102y+41=0$
E. NOTA

24. Find a polar equation for the locus of points $U(r,\ \theta)$, the sum of whose distances from the pole and $S(4,\ 0°)$ is 6.

A. $r=\dfrac{21}{6-4\cos\theta}$ B. $r=\dfrac{21}{6+4\cos\theta}$ C. $r=\dfrac{5}{3+2\cos\theta}$
D. $r=\dfrac{5}{3-2\cos\theta}$ E. NOTA

25. Find a vector equation of the line through (1, 2, 4) and (4, 2, –1).

A. $\mathbf{r} = (–1 + 5t)\mathbf{i} + (–2 + 4t)\mathbf{j} + (–4 + 3t)\mathbf{k}$ B. $\mathbf{r} = (1 + 3t)\mathbf{i} + 2\mathbf{j} + (4 – 5t)\mathbf{k}$
C. $\mathbf{r} = (1 + 4t)\mathbf{i} + (2 + 2t)\mathbf{j} + (4 – t)\mathbf{k}$ D. $\mathbf{r} = (4 + t)\mathbf{i} + (2 + 2t)\mathbf{j} – (1 – 4t)\mathbf{k}$
E. NOTA

26. The area of a regular decagon inscribed in a circle of radius 4 cm, in cm^2, is:

A. $10\sin 36°$ B. $20\sin 36°$ C. $40\sin 36°$ D. $80\sin 36°$ E. NOTA

27. The acute angle of rotation, in degrees, which will ensure the absence of the *x*'*y*' term when the graph of $2x^2+\sqrt{3}xy+3y^2-5x+2y=0$ is transformed to the *x*'-*y*' coordinate system is:

A. 30 B. 45 C. 60 D. 120 E. NOTA

28. A triangle is inscribed in a circle. The vertices of the triangle divide the circle into three arcs of length 3, 4, and 5. What is the area of the triangle?

A. 6 B. $\dfrac{18}{\pi^2}$ C. $\dfrac{9}{\pi^2}\left(\sqrt{3}-1\right)$ D. $\dfrac{9}{\pi^2}\left(\sqrt{3}+1\right)$ E. NOTA

29. How many triangles of positive area are there whose vertices are lattice points in the *xy*-plane satisfying $1\le x\le 4$ and $1\le y\le 4$?

A. 496 B. 500 C. 512 D. 516 E. NOTA

30. Find the largest positive value attained by the function $f(x)=\sqrt{8x-x^2}-\sqrt{14x-x^2-48}$, where *x* is a real number.

A. $\sqrt{7}-1$ B. 3 C. $2\sqrt{3}$ D. $\sqrt{55}-\sqrt{5}$ E. NOTA