1. If a line that is not a function contains the point (R, S) where $RS \neq 0$, then the line must also contain which of the following points?

    A. $(-R, S)$ B. $(-S, R)$ C. $(R, -S)$ D. $(S, -R)$ E. NOTA

2. How many ordered triplets (p_1, p_2, p_3) of prime numbers exist for which the sum of the numbers is 24?

    A. 9   B. 12   C. 15   D. 18   E. NOTA

3. Find the determinant of matrix L if $L = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 4 & -1 \\ 1 & 4 & 2 \end{bmatrix} \cdot \begin{bmatrix} 1 & 1 & 6 \\ 4 & 2 & 3 \\ 5 & 3 & 2 \end{bmatrix}$

    A. 38   B. 140   C. 336   D. 521   E. NOTA

4. $\frac{A + B\sqrt{5} + (C - 4\sqrt{5})i}{-29} = \frac{2}{1 + i + \sqrt{5}}$ for integers A, B, and C. Compute $A + B + C$.

    A. -18   B. -12   C. 10   D. 30   E. NOTA

5. Sansa dropped his bouncy ball from a height of 6 yards. The bouncy ball always bounces up at a constant ratio compared to the maximum height in the previous bounce. The ball bounced back to a height of 4 yards on its first bounce. The ball continues to bounce until it eventually comes to a rest. What is the total distance the ball traveled in feet?

    A. 18   B. 30   C. 54   D. 90   E. NOTA

6. If the zeroes of $J(x) = x^4 - 13x^3 + 47x^2 - 23x - 84$ are S, N, O, W with $S > N > O > W$, compute $S + N + W$.

    A. 9   B. 10   C. 11   D. 13   E. NOTA

7. Given that $B \neq \frac{220}{3}$, what value for B, in terms of A, will make the following system of equations have no solution? $\begin{cases} Ax + 20y = 3 \\ 24x + By = 11 \end{cases}$

A. $\frac{220A}{3}$ B. $\frac{A}{480}$ C. $\frac{20A}{24}$ D. $\frac{480}{A}$ E. NOTA

8. According to Newton's law of cooling, when the difference in the temperature of an object and its surroundings is measured at equal time intervals, the temperature differences form a geometric sequence. If the temperature of Allison's coffee was 26 degrees at 11:00 p.m. and 22 degrees at 11:10 p.m., what was its temperature at 10:40 p.m.? Assume that the air temperature remained constant at 20 degrees.

A. 38   B. 50   C. 54   D. 74   E. NOTA

9. The following table gives some values of $g(x)$ and $g^{-1}(x)$. Compute $A + B$.

x	0	1	2	3	4	5	?
$g(x)$	5	3	?	A	?	4	8
$g^{-1}(x)$	2	4	3	B	?	?	8

A. 3   B. 4   C. 5   D. 6   E. NOTA

10. Arya invests $25,000 in three accounts earning 6%, 8%, and 9% simple interest. She invests twice as much in the 6% account as in the 9% account. If she wants to earn $1850 in interest after one year how much should she invest at 9%?

A. $3000   B. $5000   C. $6000   D. $10000   E. NOTA

11. Trapezoid $BRAN$ is circumscribed around a circle. Points S and T are midpoints of legs $\overline{BN}$ and $\overline{RA}$ respectively. If $ST = 10$, what is the perimeter of $BRAN$?

A. 30   B. 38   C. 40   D. 48   E. NOTA

12. In triangle ABC, $AC = BC$. If $\overline{AC}$ is extended its own length through C to D and $\overline{DB}$ is drawn. Find the sum of the degree measures of angles A and D.
    A. 60   B. 90   C. 120   D. 150   E. NOTA

13. How many real solutions exist for the equation: $\sqrt{2x+9} + \sqrt{x+1} = \sqrt{x+4}$?
    A. 0   B. 1   C. 2   D. 3   E. NOTA

14. A circle centered at the origin has radius 25. How many lattice points lie on the circle?
    A. 8   B. 12   C. 16   D. 20   E. NOTA

15. The Heritage math team has 100 members with the following data. 45 are on the science team, 34 are on the debate team, and 15 play sports. 20 are on the science and debate team only, 7 are on the science team and play sports only. 6 are on the debate team and play sports only. 1 person did all 3. How many members did not do any of the 3?
    A. 12   B. 19   C. 38   D. 42   E. NOTA

16. The side lengths of a triangle are 15, 47 and $\frac{W}{2}$. How many integers values of W are possible?
    A. 29   B. 30   C. 59   D. 69   E. NOTA

17. From point A outside of circle R, two secants, $\overline{AS}$ intersecting the circle at T and $\overline{AK}$ going through the center (point R). The degree measure of angle SRT is 74 and the degree measure of angle SAK is 28. What is the degree measure of minor arc SK?
    A. 56   B. 68   C. 74   D. 81   E. NOTA

18. A rectangle with vertices (8,4), (2, 4), (8, 1) and (2, 1) is revolved about the x-axis, creating a hollowed-out cylinder. What is the volume of this resulting solid?
    A. 54π B. 90π C. 96π D. 180π E. NOTA

19. How many integral values of x does the expression $x^2 + 2x - 19$ have a negative value?

 A. 8   B. 9   C. 16   D. 17   E. NOTA

20. Simplify: $\dfrac{1}{\sqrt[3]{A^2} - \sqrt[3]{AB^2} + \sqrt[3]{B^4}}$

 A. $\dfrac{\sqrt[3]{A} + \sqrt[3]{B}}{A - B}$ B. $\dfrac{\sqrt[3]{A} - \sqrt[3]{B}}{A + B}$ C. $\dfrac{\sqrt[3]{A} + \sqrt[3]{B^2}}{A + B^2}$ D. $\dfrac{\sqrt[3]{A} + \sqrt[3]{B^2}}{A - B^2}$ E. NOTA

21. Trapezoid STAR has base $ST = 20$ and base $AR = 30$. Diagonals intersect at point K. If the area of the trapezoid is 300, what is the area of triangle KAT?

 A. 72   B. 78   C. 84   D. 96   E. NOTA

22. The width of a right rectangular prism decreased by seventy-five percent and the length increased by thirty-three and one-third percent. If the volume remained unchanged, by what percent did the height increase?

 A. 0   B. 50   C. 100   D. 300   E. NOTA

23. How many ordered pairs (A, B), where A and B are whole numbers, satisfy $2A + 3B = 72$?

 A. 11   B. 12   C. 13   D. 14   E. NOTA

24. For $k \in \mathbb{R}$, find the product of the solutions to: $\log_4 k + \log_{k^2} \dfrac{1}{8} = 1$.

 A. $\dfrac{-1}{4}$ B. $\dfrac{1}{4}$ C. $\dfrac{3}{4}$ D. 4   E. NOTA

25. Solve for k: $\dfrac{k+3}{k-1} < \dfrac{k+5}{k+2}$

 A. $k < -11$ B. $k > -11$ C. $k < 11$ D. $k > 11$ E. NOTA

26. If j and k are integers, which of the following could not be a root of the function
    $f(x) = 3x^3 + jx^2 + kx - 10$?
    A. -10 B. -5 C. $5/3$ D. 6 E. NOTA

27. How many real solutions does the equation $|k|^2 - \sqrt{k^2} - 6 = 0$ have?
    A. 0 B. 1 C. 2 D. 4 E. NOTA

28. The height of a regular square pyramid is 4 units and the length of the side of its base is 6.
    Find the volume of the smaller pyramid that results from cutting the original pyramid by a
    plane parallel to the base and passing one unit above the base.
    A. $\dfrac{81}{4}$ B. 27 C. 36 D. $\dfrac{243}{4}$ E. NOTA

29. January 1, 2024 was a Monday. What is the next year in which January 1 will fall on a
    Monday?
    A. 2028   B. 2029   C. 2030   D. 2031   E. NOTA

30. Brandon and Eddard are going running. Brandon starts running 16 minutes before Eddard.
    Brandon runs at a rate of 9 minutes per mile and Eddard runs at a rate of 8.25 minutes per
    mile. If they both start at the same location and run the same route how many minutes will
    Eddard take to catch up to Brandon?
    A. 156   B. 162   C. 176   D. 192   E. NOTA