1. Arrange the following numbers from the least to greatest.

$$w = \frac{287}{431}, x = \frac{307}{460}, y = \frac{321}{481}, z = \frac{329}{494}$$

A. *wxyz* B. *zyxw* C. *wzyx* D. *zwxy* E. NOTA

2. Two standard fair six sided dice numbered 1 through 6 are tossed. What is the probability that their product is 12?

A. 1/36 B. 1/18 C. 1/12 D. 1/9 E. NOTA

3. Compute $i^{181} + i^{-171} + i^{-899} + i^{-835} + i^{63}$

A. $-3i$ B. $-i$ C. i D. $3i$ E. NOTA

4. How many 4-digit positive integers are palindromes?

A. 81 B. 90 C. 100 D. 450 E. NOTA

5. Let $x = 2\ln 6 + 3\ln 2 + 5\ln 3 - 3\ln 18$. Compute e^x.

A. -37 B. -21 C. $\frac{20}{3}$ D. 233 E. NOTA

6. If Kaylee spends all of her money, she can buy 30 strawberries and 7 dresses, or 80 strawberries and 4 dresses. If she bought no dresses, what is the maximum whole number of strawberries she can afford?

A. 146 B. 147 C. 148 D. 149 E. NOTA

7. Compute the sum of the arithmetic series $2 + 8 + 14 + \cdots + 398$.

A. 13200 B. 13400 C. 26400 D. 26800 E. NOTA

8. In trapezoid *ABCD*, $BC \parallel AD$. Point *E* is on *AD* such that $BA = BE$ and $CB = CE = CD$. If $m\angle A = 2 \cdot m\angle D$, compute $m\angle A$ in degrees.

A. 36 B. 54 C. 60 D. 72 E. NOTA

9. Evaluate the determinant of $\begin{bmatrix} 1 & -2 & 3 \\ 2 & 1 & 5 \\ -3 & 5 & 7 \end{bmatrix}$

A. 79 B. 94 C. 114 D. 129 E. NOTA

10. A convex pentagon has vertices at $(0,-3), (4,0), (1,3), (3,-4)$, and $(-2,1)$. Compute the area enclosed by the pentagon.

A. 3 B. 6 C. 12 D. 24 E. NOTA

11. Point *A* is located at $(2,7)$, and point *B* is located at $(17,-2)$. Point *C* lies on segment *AB* such that $AC = 2BC$. Find the coordinate of *C*.

A. $(7,1)$ B. $(7,4)$ C. $(12,1)$ D. $(12,4)$ E. NOTA

12. In simplest form, $\sqrt[6]{32} \cdot \sqrt[10]{128} \cdot \sqrt[15]{2048}$ is expressed as $a\sqrt[n]{b}$. Compute $a+b+n$.

A. 35 B. 84 C. 124 D. 290 E. NOTA

13. Find the sum of all values of *x* such that $|2x-4| + |3x+6| = 8$.

A. $-\frac{104}{5}$ B. $-\frac{94}{5}$ C. $-\frac{14}{5}$ D. $-\frac{4}{5}$ E. NOTA

14. In ΔXYZ, $XZ = 13, XY = 14, YZ = 15$. Let $M, A,$ and B be the intersection between *XY* and the median, altitude, and angle bisector from *Z*, respectively. Order M, A, B from the closest to *X* to closest to *Y*.

A. *ABM* B. *AMB* C. *BAM* D. *MAB* E. NOTA

15. Let $f(3x+2) = x^3 + x - 7$. Find $f^{-1}(3)$.

A. 0 B. 2 C. 8 D. 23 E. NOTA

16. Find the coefficient of the x^8 term of $\left(x^2 + \frac{1}{x}\right)^{13}$

A. 286 B. 715 C. 1287 D. 1716 E. NOTA

17. Consider the graph of $x^3y + xy^3 = 10$. What kind of symmetry does it exhibit?

I. x-axis II. y-axis III. Origin IV. $y = x$

A. I, II B. III only C. III, IV D. I, II, III, IV E. NOTA

18. Compute $a^3 + \frac{1}{a^3}$ if $a + \frac{1}{a} = 6$.

A. 198 B. 204 C. 210 D. 216 E. NOTA

19. A hollow rectangular prism measures 4 inches by 6 inches by 8 inches. The faces have negligible thickness. Which of the following is closest to the volume, in cubic inches, of the space that is within one inch of the prism?

A. 200 B. 300 C. 400 D. 450 E. 500

20. The domain for $f(x) = \sqrt{\log_2(\log_3(\log_4(x)))}$ is $[N, \infty)$. Compute the value of $\log_2 N$.

A. 3 B. 6 C. 9 D. 81 E. NOTA

21. A common internal tangent to two circles has length 6, and a common external tangent to the same two circles has length 10. If the radii of both circles are integers, find the sum of the possible areas of the two circles.

A. 90π B. 289π C. 325π D. 357π E. NOTA

22. $\sqrt{44 + 16\sqrt{6}}$ can be expressed as $a\sqrt{b} + c\sqrt{d}$ for integers a, b, c, d where b, d are not divisible by the square of any prime. Compute $a + b + c + d$..

A. 11 B. 14 C. 15 D. 16 E. NOTA

23. For a positive integer *n*, take the sum of the digits of *n*, then repeat the process until a one digit number remains. Define the result of this process as $d(n)$. For example, $d(2017) = d(2 + 0 + 1 + 7) = d(10) = d(1 + 0) = 1$. Compute $\sum_{n=1}^{2017} d(n)$.

A. 10081 B. 10085 C. 28117 D. 90721 E. NOTA

24. Find the number of integers x with $|x| \leq 100$ such that

$$\frac{x+1}{x^2-6x+5} - \frac{2x}{x^2+5x-6} \leq \frac{x+3}{x^2+x-30}$$

A. 97 B. 100 C. 103 D. 192 E. NOTA

25. For how many positive integers *n* less than 2017 is $\frac{n}{840}$ a terminating decimal?

A. 2 B. 24 C. 48 D. 96 E. NOTA

26. Find the number of solutions to the system of equations $xy = z, yz = 2x, zx = 3y$.

A. 4 B. 5 C. 8 D. 9 E. NOTA

27. A container in the shape of a circular cylinder contains water with depth of 3 centimeters. A right circular cone with height of 8 cm is then placed in the container, with the base flush with the bottom surface of the cylindrical container. The water level rises by 1 cm. Find the minimum depth of water (in cm) in the container initially such that when the same cone is placed in the container in the same manner, it is entirely submerged.

A. 6 B. $\frac{20}{3}$ C. $\frac{48}{7}$ D. 8 E. NOTA

28. A parabola has focus at $(5, 3)$ and directrix along the line $3x + 4y = 12$. Find the length of its latus rectum.

A. $\frac{3}{2}$ B. 3 C. 6 D. 12 E. NOTA

29. The parabola in the problem above can be expressed as $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$ with integers A, B, C, D, E, F; $A > 0$; and $\gcd(A, B, C, D, E, F) = 1$. Compute $A + B + C + D + E + F$.

A. -150 B. 19 C. 95 D. 475 E. NOTA

30. The objective of the game 24 is to create 24 from 4 numbers using the 4 arithmetic operations: $+, -, \times, \div$. For example, for $\{2, 3, 6, 12\}$, we have $2 \times 3 + 6 + 12 = 24$, $3 \times (12 - 2) - 6 = 24$, or quite a few other distinct solutions. For $\{4, 8, 8, 11\}$, there exists a unique solution, not counting variations obtained through commutative and/or associative properties. Which of the four operations goes unused in this solution?

A. $+$ B. $-$ C. $\times$ D. $\div$