1. If $20^{18} = a^x b^y$ where a and b are prime numbers, what is $a + b + x + y$?
   (A) 55 (B) 61 (C) 67 (D) 73 (E) NOTA

2. What is the units digit of 3^{2018}?
   (A) 1 (B) 3 (C) 7 (D) 9 (E) NOTA

3. The base 7 representation of a positive integer is AB and its base 5 representation is BA, where A and B are digits from 1 to 4, inclusive. What is the integer expressed in base 10?
   (A) 17 (B) 21 (C) 24 (D) 24 (E) NOTA

4. Let M be the largest perfect square less than 2018 and N be the smallest perfect square greater than 2018. What is $N - M$?
   (A) 83 (B) 85 (C) 87 (D) 89 (E) NOTA

5. Which one of the following numbers represented in base 8 is divisible by 7?
   (A) 1234_8 (B) 2345_8 (C) 3456_8 (D) 4567_8 (E) NOTA

6. What is the largest prime factor of $3^{12} - 1$?
   (A) 29 (B) 59 (C) 73 (D) 89 (E) NOTA

7. How many pairs of positive integers x and y are there such that $xy + 3x + 5y = 45$?
   (A) 3 (B) 4 (C) 5 (D) 6 (E) NOTA

8. How many two-digit numbers are there having exactly 12 positive divisors?
   (A) 2 (B) 3 (C) 4 (D) 5 (E) NOTA

9. What is the largest two-digit prime factor of the number $2 \cdot 4 \cdot 6 \cdot \cdots \cdot 98 \cdot 100$?
   (A) 89 (B) 73 (C) 47 (D) 37 (E) NOTA

10. How many three-digit positive integers leave a remainder of 3 when divided by 5 and a remainder 3 when divided by 7?
    (A) 26 (B) 28 (C) 29 (D) 30 (E) NOTA

11. If two roots of the equation $x^2 - 45x + m = 0$ are prime numbers, what is the value of m?
    (A) 200 (B) 234 (C) 126 (D) 86 (E) NOTA

12. How many positive integers less than or equal to 504 are there that are relatively prime to 504?
(A) 100 (B) 144 (C) 196 (D) 324 (E) NOTA

13. 24024 can be written as a product of four consecutive positive integers. What is the sum of the four consecutive positive integers?
(A) 50 (B) 54 (C) 58 (D) 58 (E) NOTA

14. How many pairs of positive integers (x, y) are there such that the difference of the squares of the two numbers is 72?
(A) 5 (B) 6 (C) 12 (D) 24 (E) NOTA

15. Let m be the number of 4-digit palindromes that are multiples of 9. Let n be the number of 4-digit palindromes that are multiples of 7. What is $m + n$?
(A) 28 (B) 30 (C) 32 (D) 34 (E) NOTA

16. Suppose that a and b are positive integers satisfying $(a^2 + 7)(a + 4)^2 = (b - 1)^2$. What is the value of $a + b$?
(A) 14 (B) 17 (C) 28 (D) 32 (E) NOTA

17. How many positive integers d are there such that the remainder equals 8 when the number 2018 is divided by d?
(A) 10 (B) 11 (C) 15 (D) 16 (E) NOTA

18. Let n be the smallest positive integer such that the expansion of $\left(x^3 + \frac{1}{x^5}\right)^n$ has a constant term. What is the constant term?
(A) 20 (B) 42 (C) 56 (D) 84 (E) NOTA

19. If m and n are positive integers with $m > n$ such that $m^2n + mn^2 + m + n = 77$, what is the value of $m^2 + n^2$?
(A) 25 (B) 29 (C) 61 (D) 65 (E) NOTA

20. How many positive integers N are there such that $N^3 + 100$ is divisible by $N + 4$?
(A) 9 (B) 7 (C) 5 (D) 3 (E) NOTA

21. Suppose that x and y are positive integers satisfying $18x = y^3$. What is the smallest possible value of $x + y$?
(A) 18 (B) 24 (C) 27 (D) 30 (E) NOTA

22. There exists one prime number p such that $73p + 1$ is a perfect square. What is the sum of the digits of p ?
(A) 8 (B) 7 (C) 6 (D) 5 (E) NOTA

23. If a 6-digit integer $1234ab$ is divisible by 99, what is the value of $a^2 + b^2$?
(A) 13 (B) 34 (C) 52 (D) 74 (E) NOTA

24. The number $1 \cdot 1! + 2 \cdot 2! + 3 \cdot 3! + \cdots + 100 \cdot 100!$ ends with a string of 9s. How many consecutive 9s are at the end of the number?
(A) 20 (B) 22 (C) 24 (D) 26 (E) NOTA

25. If p, q, and r are odd prime numbers with $p < q < r$ such that $pqr = 11(p + q + r)$, what is $p + q + r$?
(A) 31 (B) 29 (C) 25 (D) 21 (E) NOTA

26. Find the remainder when 2^{2020} is divided by 100.
(A) 16 (B) 36 (C) 56 (D) 76 (E) NOTA

27. If N^3 is the greatest perfect cube number that divides 20!, what is N?
(A) 360 (B) 720 (C) 1440 (D) 2880 (E) NOTA

28. Find the greatest integer n such that 2^n divides $6^{2018} - 4^{1009}$.
(A) 2022 (B) 2021 (C) 2020 (D) 2018 (E) NOTA

29. What is the largest possible value of $a + b + c$ where a, b, and c are positive integers such that $ab + bc + ca = abc$?
(A) 9 (B) 10 (C) 11 (D) 12 (E) NOTA

30. There exists one positive integer n for which $n^4 - 80n^2 + 100$ is a positive prime. What is the prime number?
(A) 173 (B) 181 (C) 211 (D) 233 (E) NOTA