

Where applicable, “E) NOTA” indicates that none of the above answers is correct.

1. Compute $\gcd(4052, 9117)$.

- A) 1 B) 1013 C) 2026 D) 4052 E) NOTA

2. There are positive integers q and r , with $0 < r < 101$, such that $1001 = 101q + r$. Find $q + r$.

- A) 101 B) 103 C) 105 D) 107 E) NOTA

3. Find the units digit of 2^{2026} .

- A) 2 B) 4 C) 6 D) 8 E) NOTA

4. Determine the number of factors of 7 in $2401!$.

- A) 4 B) 343 C) 392 D) 400 E) NOTA

5. What is the smallest positive integer solution to $3x + 1 \equiv 0 \pmod{11}$?

- A) 1 B) 7 C) 10 D) there is no solution E) NOTA

6. Compute the sum of the positive integer divisors of 1001.

- A) 1002 B) 1032 C) 1201 D) 1344 E) NOTA

7. A *prime trio* consists of the prime numbers p , $p+2$, and $p+6$. Find the greatest possible sum of the three primes in a prime trio such that $p+6 < 200$.

- A) 551 B) 569 C) 581 D) 589 E) NOTA

8. The digit d such that 21 divides the 9-digit integer $28577d240$ is one of the numbers in which of these answer choices?

- A) 0 or 1 B) 2 or 3 C) 4 or 5 D) 6 or 7 E) NOTA

9. A positive integer is called a *trippyprime* if it is the product of one copy each of three distinct prime numbers (e.g., 105 is a trippyprime since $105 = 3 \cdot 5 \cdot 7$). Let N be a four-digit trippyprime whose digits sum of 2. There are two possible values of N . Let s_1 be the sum of the prime factors in one of the two trippyprimes, and let s_2 be the sum of the prime factors in the other trippyprime. Find $|s_1 - s_2|$.

- A) 77 B) 87 C) 90 D) 97 E) NOTA

10. Which of the following is not a prime factor of $3^{16} - 2^{16}$?

- A) 17 B) 47 C) 97 D) 401 E) NOTA

11. Express the fraction $\frac{659}{64}$, a quotient of two base-10 numerals, in hexadecimal.

- A) $A.0F_{16}$ B) $41.3F_{16}$ C) $A.4C_{16}$ D) $B.4_{16}$ E) NOTA

12. How many positive integers less than 11088 are relatively prime with 11088?

- A) 960 B) 1540 C) 1848 D) 2880 E) NOTA

13. There are integers a and b such that $132a + 509b = 1$. Compute the smallest possible value of $|a + b|$.

- A) 20 B) 24 C) 28 D) 32 E) NOTA

14. Let m be the smallest positive three-digit integer such that $m \equiv 4 \pmod{7}$, and let n be the smallest positive four-digit integer such that $n \equiv 2 \pmod{11}$. Find $\gcd(m, n)$.

- A) 1 B) 2 C) 4 D) 6 E) NOTA

15. Find the average of all positive integer solutions to the congruence $21x \equiv 35 \pmod{77}$ that are less than 77.

- A) 38 B) 39 C) 41 D) 42 E) NOTA

16. Find the remainder when 2026^{30} is divided by 21.

- A) 3 B) 7 C) 11 D) 13 E) NOTA

17. The integer solution to the system of congruences $x \equiv 4 \pmod{11}$ and $x \equiv 3 \pmod{17}$ can be written in the form $x \equiv n \pmod{m}$, where n and m are positive integers. Find the smallest possible value of $m + n$.

- A) 199 B) 224 C) 287 D) 337 E) NOTA

18. Over the interval $\left[\frac{11}{27}, \frac{11}{26}\right]$, there is a rational number $\frac{m}{n}$ such that n has the minimum possible value for such a fraction. Compute $m + n$.

- A) 19 B) 25 C) 31 D) 37 E) NOTA

19. An integer N is the product of one copy each of two distinct primes p and q . The sum of the squares of the positive divisors of N is 1220. What is $|p - q|$?

- A) 6 B) 8 C) 10 D) 12 E) NOTA

20. Find the number of integers k such that $9k^2 - 8$ is a perfect square.

- A) 0 B) 1 C) 2 D) 4 E) NOTA

21. Let m and n be distinct positive integers such that $m + k$ divides $n + k$ for all integer values of k from 1 to 10, inclusive. Find the minimum possible value of n .

- A) 2521 B) 27721 C) 362881 D) 3628801 E) NOTA

22. Let a , b , and c be positive integers such that $\sqrt{a + 2\sqrt{2026}} = \sqrt{b} + \sqrt{c}$. Find the minimum possible value of a .

- A) 202 B) 203 C) 1015 D) 2027 E) NOTA

23. Find the remainder when $42!$ is divided by 47.

- A) 1 B) 26 C) 45 D) 46 E) NOTA

24. Which of the following is a prime number?

- A) $37^2 + 1$ B) $48^2 + 1$ C) $79^2 + 1$ D) $88^2 + 1$ E) NOTA

25. Let N be the smallest positive integer that has 120 positive integers less than and relative prime with N . Compute the remainder when N is divided by 17.

- A) 7 B) 8 C) 12 D) 16 E) NOTA

26. Let N be the smallest positive integer such that the sum of the positive integral divisors of N is 120. Compute the remainder when N is divided by 17.

- A) 1 B) 3 C) 5 D) 16 E) NOTA

27. Let N be the smallest positive integer that has exactly 120 divisors. Compute the remainder when N is divided by 17.

- A) 3 B) 5 C) 8 D) 16 E) NOTA

28. Suppose that $k = \frac{\sum_{j=1}^n j^2}{n}$. For how many positive integral values of n , with $1 \leq n \leq 2026$, is k an integer?

- A) 669 B) 671 C) 673 D) 675 E) NOTA

29. Find $\gcd(2^{2206} - 1, 2^{2026} - 1)$

- A) 1 B) 3 C) 31 D) 127 E) NOTA

30. Let x and y be positive integers that satisfy the equation:

$$x^3 + x^2y + xy^2 + y^3 = 8(x^2 + xy + y^2 + 1)$$

Compute $x + y$.

- A) 12 B) 14 C) 16 D) 18 E) NOTA