SOML MEET 2 **NAME: ______________**
EVENT 3 **TEAM: ______________**
Number Sense **SCHOOL: _____________**

1. [2 Points] Simplify and give the exact value of $2 \cdot 2^{2000} + 3 \cdot 2^{2001}$. Express your answer as a single exponential expression (a number raised to a power).

ANS:__________________

2. [3 Points] If you multiply the first 2002 prime numbers, how many zeros will there be at the end of the product?

ANS:__________________

3. [5 Points] By definition, n! = 1 • 2 • 3 • 4 • ... • n. If A = 20! • 19! • 18! • 2! • 1!, then how many times does 3 appear in the prime factorization of A?

ANS:________________

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1. [2 Points] Simplify and give the exact value of $2 \cdot 2^{2000} + 3 \cdot 2^{2001}$. Express your answer as a single exponential expression (a number raised to a power).

Solution:

$$2 \cdot 2^{2000} + 3 \cdot 2^{2001} = 2^{2000}\left(2 + 3 \cdot 2\right) = 2^{2000} \cdot 8 = 2^{2000} \cdot 2^{3} = 2^{2003}$$

ANS: __2^{2003}_______________

2. [3 Points] If you multiply the first 2002 prime numbers, how many zeros will there be at the end of the product?

Solution:

Each time a 2 and a 5 can be paired up the factor of 10 results. Each factor of 10 produces a zero at the end of the product. Since the product is of prime numbers, there is only one way to get a 10, from 2 and 5. So, there will be only 1 zero at the end of the product.

ANS: __1 zero__

3. [5 Points] By definition, n! = 1 • 2 • 3 • 4 • ... • n. If A = 20! • 19! • 18! • 2! • 1!, then how many times does 3 appear in the prime factorization of A?

Solution:

In the expression 20! • 19! • 18! • ... 2! • 1!, the number 20 will appear as a factor once (in 20!), 19 will appear twice (in 20! and 19!), 18 will appear three 3 times (in 20!, 19!, and 18!), and so on, until we get to 1, which will appear as a factor twenty times (in 20!, 19!, 18!, ..., and 1!). Only the 18’s, 15’s, 12’s, 9’s, 6’s and 3’s will “contribute” 3’s to the prime factorization of A.

Each of the three 18’s will have two 3’s in its prime factorization, accounting for six 3’s. Each of the six 15’s will have one 3 in its prime factorization, accounting for six more 3’s. Each of the nine 12’s will have one 3 in its prime factorization, accounting for nine 3’s. Each of the twelve 9’s will have two 3’s in its prime factorization, accounting for twenty-four 3’s. Each of the fifteen 6’s will have one 3 in is prime factorization, accounting for fifteen 3’s. Each of the eighteen 3’s will contribute one more 3 to the prime factorization of A. In all, there will be seventy-eight 3’s in the prime factorization of A.

ANS: __78__