2019 DUKE MATH MEET RELAY ROUND PROBLEM 1

Position 1. We can write 2019 as

$$2019 = a^4 + b^4 + c^4 + d^4 + e^4,$$

where a, b, c, d, and e are integers. Find the minimum value of $|a + b + c + d + e|$, where $|x|$ is the absolute value function.

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Position 2. Let T = TNYWR, and let $ABCDEFGH$ be a regular octagon centered at O with $AO = 4T$. Determine the area of the incircle of $ACEG$.

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Position 3. Let T = TNYWR, and let $N = \frac{T}{\pi}$. Suppose a bag of 15 apples has N rotten apples. What is the probability that if I randomly pick apples from the bag without replacement, the 11^{th} apple I draw is the last rotten one? Express your answer as a common fraction.

2019 DUKE MATH MEET RELAY ROUND PROBLEM 2

Position 1. A cafeteria has 4 entrees and 5 desserts. How many different meals can Jung eat if he eats either 1 or 2 entrees and either 1 or 2 desserts?

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Position 2. Let T = TNYWR. Find the total number of positive integers $n \leq T$ such that $n^4 + 5n^2 + 9$ is not divisible by 5.

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Position 3. Let T = TNYWR. In the diagram below, let $AB = BC = \frac{T}{2}$, and $BD = \frac{T}{3}$. Find the length of DE.