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.
Position 2. Let $T = \text{TNYWR}$, 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 $T = \text{TNYWR}$, 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?
Position 2. Let $T = \text{TNYWR}$. Find the total number of positive integers $n \leq T$ such that $n^4 + 5n^2 + 9$ is not divisible by 5.
Position 3. Let $T = \text{TNYWR}$. In the diagram below, let $AB = BC = \frac{T}{2}$, and $BD = \frac{T}{3}$. Find the length of DE.