

2018 Special Camp - Fun Pset

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Problem 1: One person's room and board at Camp costs 900/- per day, and 8 hours of classroom time costs 4500/-. If you invite 25 students, then BdMO can finance the camp with only a 4000/- fee from each student. How much will each student have to pay if n students attend?

Problem 2: (2011 N5, IMO P5) Let f be a function from the set of integers to the set of positive integers. Suppose that for any two integers m and n , the difference $f(m)f(n)$ is divisible by $f(mn)$. Prove that for all integers m, n with $f(m) \leq f(n)$ the number $f(n)$ is divisible by $f(m)$.

Solve 2011 P5 given above and comment on how it isn't remotely similar to 2018 P5 and one should never try to use the somewhat analytic methods from one on the other.

Problem 3: Write down how we might best leverage an IMO gold medal to obtain

1. Lots of money (Say, 10 million usd)
2. Total control of the government of a country

Problem 4: Label the vertices of a regular $3n$ -gon alternately with 1, 2, 3. Consider a decomposition of the polygon into triangles with finitely many vertices, all located in the interior or boundary of the polygon. Label these vertices with 1, 2 or 3 so that no side of the $3n$ -gon has all three labels. Prove that there are at least n triangles in the decomposition whose vertices have all three labels.

Problem 5: The Trapezium Inequality states that, in a trapezium $ABCD$ with $BD > AC$, we have $BD^2 > AB \cdot CD + AD \cdot BC > AC^2$.

Prove the Trapezium Inequality, and use it to solve 2018 IMO P6.

Problem 6: Find the answer to the ultimate question of life, the universe, and everything.