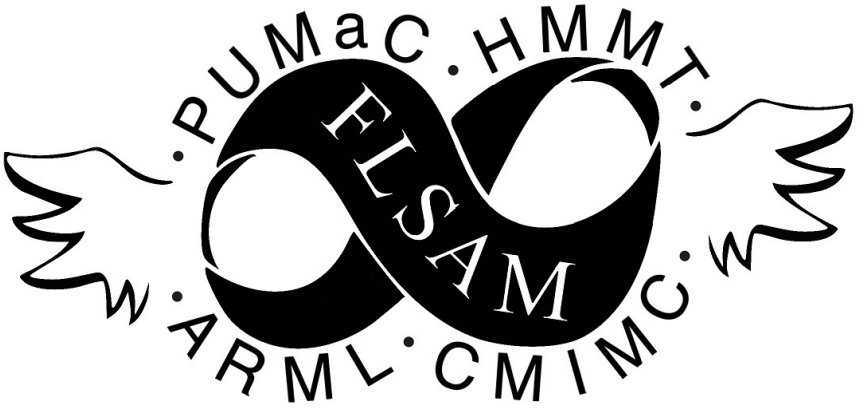
Florida Student Association of Mathematics



2025 FLSAM PUMAC Tryout

October 25-26, 2025

Round 1: Algebra

Welcome to the **2025 FLSAM PUMAC Tryout!** This is round one of four, each of which will consist of four problems to be completed in 30 minutes. There is no penalty for wrong answers. Good luck!

Answer Format:
All answers must be **fully simplified**; note that this is not necessarily the same as rules regarding answer formats for PUMAC. Restrictions include but are not limited to fully reduced fractions, rationalizing denominators, and fully simplifying radicals. All reasonable fully simplified forms will be accepted in the case that multiple exist. These instructions apply for the other three rounds but will not be repeated.

1. Distinct reals a, b, c are the roots of the cubic $x^3 - 10x^2 + kx - 2$, for some real k. Given that $ax^2 + bx + c = 0$ has a unique real solution, compute k.

2. The graphs of $y = x^3 - 5x^2 + 7x + 4$ and $y = 2x^2 - 6$ intersect at A, B, and C. Find the sum of the coordinates of the centroid of triangle ABC.

3. For each nonnegative integer k, $P_k(x)$ is a real polynomial of degree k with leading coefficient $\frac{k+1}{k!}$. For each k, we have that

$$P_k(k) = P_{k+1}(k) = P_{k+2}(k) = \cdots$$

Given that $P_{100}(100)$ is an integer, compute the number of positive integer divisors of $P_{100}(100)$.

4. The values $a_1, a_2, \ldots, a_{20}$ are complex numbers. A sequence $\{s_n\}_{n\geq 1}$ of complex numbers is called *princely* if

$$s_n = a_1 s_{n-1} + a_2 s_{n-2} + \cdots + a_{20} s_{n-20}$$

for all $n > 20$. Princely sequences $\{s_{1,n}\}_{n\geq 1}, \{s_{2,n}\}_{n\geq 1}, \ldots, \{s_{20,n}\}_{n\geq 1}$ are such that

- $\left|\frac{s_{1,n}}{s_{2,n}}\right|, \left|\frac{s_{2,n}}{s_{3,n}}\right|, \ldots, \left|\frac{s_{19,n}}{s_{20,n}}\right| > n$ for all positive integers n, and
- $n^{k-\frac{1}{2}} < |s_{1,n} s_{2,n} \ldots s_{20,n}| < n^{k+\frac{1}{2}}$ for infinitely many positive integers n.

Find the 6th largest possible integer value of k.

Q1	Q2	Q3	Q4