- Virginia Tech Mathematics Contest. Sat., Oct. 27. **Sign-up deadline: Sep. 28**.
- Putnam Mathematical Competition. Sat., Dec. 1. **Sign-up deadline: Oct. 5**.

LSU Undergraduate Math Club - Fall 2018

Sep. 10: Introduction to Problem-Solving

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Summary Information for Collegiate Mathematics Contests:

- **Content.** The **majority** of the problems do not require anything beyond calculus, but any topic from an undergraduate math course may appear.
- **Format.** The Virginia Tech (Regional) Math Contest (VTRMC) is given in a morning session consisting of 7 problems. The Putnam Exam consists of a morning and afternoon session with 6 problems each.
- **Grading.** Each problem is graded out of **10** points, for a maximum possible score of 70 on the VTRMC and 120 on the Putnam. Little partial credit is given; especially on the Putnam, as a submitted problem will typically receive **0, 1, 2, 9,** or **10** points.
- **Median and performance.** The national median in both contests is typically **0** or **1** point! This is among hundreds or thousands of the best math and science students nationwide; MIT alone often has 300+ competitors. At LSU the majority of students (since 2011) have earned positive scores – practicing at the weekly Problem-Solving Seminar helps a lot!
- **Just one problem. . . .** The harsh grading is an **opportunity to stand out:** Getting full credit (10 points) on one problem is usually enough to place in the top ∼ 25% nationally. This is great for summer internship, research, and/or graduate school applications!
- **Creativity.** There is usually more than one way to solve a problem. Good problems in collegiate math contests always have an interesting theoretical basis – the more math you know, the more approaches you can try!
- **Collegiate Journals.** There are also excellent problem sections in several mathematics journals: *American Mathematical Monthly; Mathematics Magazine; College Mathematics Journal; Math Horizons.* This is a great **introduction to mathematics research**, as most problems will require weeks/months of work and consultation with a professor.
- **MATH 3903.** You can earn 2 credits in a Pass/Fail course for participating in the weekly Problem-Solving Seminar (Fall), or coming to weekly group meetings for working on Journal problems (Spring).

Sample Problems

1. Evaluate
$$\int_{-2}^{2} \frac{\sqrt{3+x}}{\sqrt{3-x}+\sqrt{3+x}}\,dx.$$

2. [Putnam **1987 B1**] Evaluate
$$\int_{2}^{4} \frac{(\ln(9-x))^{1/2}}{(\ln(9-x))^{1/2}+(\ln(x+3))^{1/2}}\,dx.$$

3. Suppose that L_1 and L_2 are parallel lines in the plane, and let P be a point. Show that there is a constant α such that for any line through P that intersects L_1 at the point A_1, and L_2 at the point A_2, the rays from P satisfy $\overrightarrow{PA_2} = \alpha\overrightarrow{PA_1}$. In particular, α only depends on L_1, L_2, and P.

4. [Putnam **2017 B1**] Let L_1 and L_2 be distinct lines in the plane. Prove that L_1 and L_2 intersect if and only if, for every real number $\lambda \neq 0$ and every point P not on L_1 or L_2, there exists points A_1 on L_1 and A_2 on L_2 such that $\overrightarrow{PA_2} = \lambda\overrightarrow{PA_1}$.