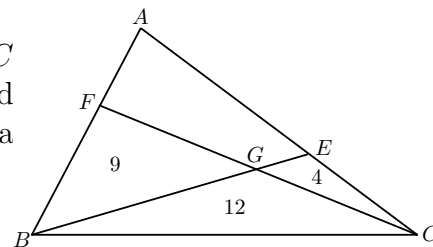


WISCONSIN MATHEMATICS, SCIENCE & ENGINEERING TALENT SEARCH

PROBLEM SET V (2017-2018)

February 2018

- Find the largest perfect square that has no even digits.
- In the adjoining figure, points E and F are chosen on the sides AC and AB of $\triangle ABC$ and G is the intersection of the segments BE and CF . The area of $\triangle BGF$ is 9, the area of $\triangle BGC$ is 12, and the area of $\triangle CGE$ is 4. Find the area of quadrilateral $AFGE$.



- Show that

$$\frac{1}{2} \cdot \frac{3}{4} \cdot \frac{5}{6} \cdots \frac{2^{2018} - 1}{2^{2018}} < \frac{1}{10^{100}}.$$

- In an after-school checkers club, each student in the club plays each other student exactly once in a game of checkers (and each game ends with one student winning). Prove that after all the games, the students can line up in some way so that each student won her game of checkers against the student ahead of her in line (except the first student, who has no one ahead of her).
- A group of students from a class go to a carnival. The students go one at a time, with each student arriving and leaving at different times. Once a student leaves, they don't come back. We know that for any three students in the class, at least two of them were at the carnival at the same time. Show that we can choose two time instances so that every student from the class is present at at least one of those times (and maybe both).

You are invited to submit a solution even if you get just one problem. Please do not write your solutions on this problem page. Remember that solutions require a proof or justification.

Find old and current problems and information about the talent search at: <http://www.math.wisc.edu/talent>

Find an introduction to techniques for solving problems like these at: <https://goo.gl/pqq32m>

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