BmMT 2025 Online

Individual Tiebreaker Round

June 7, 2025

Time limit: 15 minutes.

Instructions: This tiebreaker contains 3 short answer questions. All answers must be expressed in simplest form unless specified otherwise. You will submit answers to the problem as you solve them, and may solve problems in any order. You will not be informed whether your answer is correct until the end of the tiebreaker. You may submit multiple times for any of the problems, but **only the last submission for a given problem will be graded**. The participant who correctly answers the most problems wins the tiebreaker, with ties broken by the time of the last correct submission.

No calculators. Protractors, rulers, and compasses are permitted.

- Carry out any reasonable calculations. For instance, you should evaluate $\frac{1}{2} + \frac{1}{3}$, but you do not need to evaluate large powers such as 7^8.
- Write rational numbers in lowest terms. Decimals are also acceptable, provided they are exact. You may use constants such as π in your answers.
- Move all square factors outside radicals. For example, write $3\sqrt{7}$ instead of $\sqrt{63}$.
- Denominators do *not* need to be rationalized. Both $\frac{\sqrt{2}}{2}$ and $\frac{1}{\sqrt{2}}$ are acceptable.
- Do not express an answer using a repeated sum or product.
- All answers should be written in the form of numbers only. When encountering ratios, express them using integers or fractions and do not use colon notation, for example, use $\frac{3}{4}$ instead of 3:4.
- Do not include any units in your answers.
- For fractions, both improper fractions and mixed numbers are acceptable.

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1. There are 80 students in a class. Among them, 40 like math, 30 like science, and 20 do not like math or science. Find the number of students in the class that like both math and science.

2. Let $ABCD$ be a square. Points E and F are placed inside $ABCD$ so that triangles $\triangle AEF$ and $\triangle CEF$ are equilateral. Compute the ratio of the area of $ABCD$ to the area of $\triangle AEF$.

3. How many positive integers $n \leq 2025$ can be written as $n = (p+q)^2 + p + q$, where p and q are (not necessarily distinct) prime divisors of n?