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 be informed if an answer submission is correct or incorrect upon submission. Resubmissions are allowed, but incorrect submissions incur a penalty if the question is ultimately solved correctly. In addition, to prevent excessive guessing, after making an incorrect submission, you may not make another submission for 30 seconds.

No calculators.

1. A very tired audience of 9001 attends a concert of Haydn's Surprise Symphony, which lasts 20 minutes. Members of the audience fall asleep at a continuous rate of $6t$ people per minute, where t is the time in minutes since the symphony has begun.

   The Surprise Symphony is named such because when $t = 8$ minutes, the orchestra plays exactly one very loud note, waking everyone in the audience up. After that note, though, the audience continues to fall asleep at the same rate as before. Once a member of the audience has fallen asleep, he or she will stay asleep except for the rude awakening when $t = 8$ minutes.

   How many collective minutes does the audience sleep during the symphony?

2. Evaluate the limit $\lim\limits_{n \to \infty} \left(\dfrac{n^2 + n + 3}{n^2 + 3n + 5} \right)^n$.

3. Evaluate
$$\frac{\int_0^\infty (1 + x^2)^{-2012} \, dx}{\int_0^\infty (1 + x^2)^{-2011} \, dx}.$$