1. The length of the first side of a triangle is 1, the length of the second side is 11, and the length of the third side is an integer. Find that integer.

2. Suppose $a$, $b$, and $c$ are positive numbers such that $a + b + c = 1$. Prove that $ab + ac + bc \leq \frac{1}{3}$.

3. Prove that 
\[
1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \cdots + \frac{1}{100}
\]
is not an integer.

4. Find all of the four-digit numbers $n$ such that the last four digits of $n^2$ coincide with the digits of $n$.

5. **Bonus Problem** (more complicated than the previous problems.)

   Several ants are crawling along a circle with equal constant velocities (not necessarily in the same direction). If two ants collide, both immediately reverse direction and crawl with the same velocity. Prove that, no matter how many ants and what their initial positions are, they will, at some time, all simultaneously return to the initial positions.