1. Let $A$ be the area of the region in the first quadrant bounded by the line $y = x/2$, the $x$-axis, and the ellipse $\frac{1}{9}x^2 + y^2 = 1$. Find the positive number $m$ such that $A$ is equal to the area of the region in the first quadrant bounded by the line $y = mx$, the $y$-axis, and the ellipse $\frac{1}{9}x^2 + y^2 = 1$.

2. Find the least number $A$ such that for any two squares of combined area 1, a rectangle of area $A$ exists such that the two squares can be packed in the rectangle (without interior overlap). You may assume that the sides of the squares are parallel to the sides of the rectangle.

3. Find all real-valued continuously differentiable functions $f$ on the real line such that for all $x$,

   $$(f(x))^2 = \int_0^x ((f(t))^2 + (f'(t))^2)dt + 1990$$

4. Prove that there exist infinitely many integers $n$ such that $n$, $n + 1$, $n + 2$ are each the sum of two squares of integers. [Example: $0 = 0^2 + 0^2$, $1 = 0^2 + 1^2$, $2 = 1^2 + 1^2$.]