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by parmenides51

1 Determine all polynomials $p(x)$ with non-negative integer coefficients such that $p(1) = 7$ and $p(10) = 2014$.

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2 Three circles that touch each other externally have all their centers on one fourth circle with radius R. Show that the total area of the three circle disks is smaller than $4\pi R^2$.

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3 Determine all functions $f : \mathbb{R} \to \mathbb{R}$, such that

$$f(f(x+y) - f(x-y)) = xy$$

for all real x and y.

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4 A square is cut into a finitely number of triangles in an arbitrary way. Show the sum of the diameters of the inscribed circles in these triangles is greater than the side length of the square.

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5 In next year's finals in Schools Mathematics competition, 20 finalists will participate. The final exam contains six problems. Emil claims that regardless of results, there must be five contestants and two problems such that either all the five contestants solve both problems, or neither of them solve any of the two problems. Is he right?

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6 Determine all odd primes p and q such that the equation $x^p + y^q = pq$ at least one solution (x, y) where x and y are positive integers.
