An Exponential Take on Brocard's Problem

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Abstract

This paper explores a modified version of the curious and intriguing Brocard's Problem, which searches for solutions for integer n that would generate a square number, m^2 when the sum of the factorial of n (denoted as $n!$) and 1 is taken. Two methods were used to modify the formula in the efforts to create a new equation that would possibly have more solutions, or even patterns to its solutions. The first method involved rewriting Brocard's equation to be equal to different powers of the integer m such as m^3 and m^4 and adding positive integers other than 1 to the $n!$ After this method did not create any useful equations, a new method was used. The second method focused on changing n to an exponent instead of finding the factorial of n. While neither method was successful in finding a new equation that would have predictable solutions for n, many conclusions were made about perfect squares and the significance of numbers that are rounded.