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On the Diophantine equation $\frac{q^n-1}{q-1} = y$

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Abstract: There exist many results about the Diophantine equation $(q^n - 1)/(q - 1) = y^m$, where $m \geq 2$ and $n \geq 3$. In this paper, we suppose that $m = 1$, n is an odd integer and q a power of a prime number. Also let y be an integer such that the number of prime divisors of $y - 1$ is less than or equal to 3. Then we solve completely the Diophantine equation $(q^n - 1)/(q - 1) = y$ for infinitely many values of y . This result finds frequent applications in the theory of finite groups.

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