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Title: Imaginary cyclic fields of degree $p - 1$ whose ideal class groups have p -rank at least two

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Let p be a prime number which is congruent to 3 modulo 4. For an odd positive integer n , we define a quadratic field $k_{p,n}$ by $k_{p,n} := \mathbb{Q}(\sqrt{4 - p^{pn}})$. Moreover let $M_{p,n}$ be the composite field of $k_{p,n}$ and the maximal real subfield of the p th cyclotomic field. Then $M_{p,n}$ is an imaginary cyclic fields of degree $p - 1$. In this paper, we prove that the p -rank of ideal class groups of $M_{p,n}$ is at least 2 for any odd integer $n \geq 1$ except for $(p, n) = (3, 1)$. Furthermore, we can show $M_{p,n} \neq M_{p,m}$ for any distinct two integers n and m . As a consequence, we see that there exist infinitely many imaginary cyclic field of degree $p - 1$ whose ideal class group have p -rank at least 2.

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