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

Author(s): Yasuhiro Kishi

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 pth 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.

Address:
Yasuhiro Kishi
Department of Mathematics
Aichi University of Education
1 Hirosawa, Igaya-cho
Kariya-shi Aichi 448-8542
Japan