Title: On $K$-Derived Quartics

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Abstract:

Let $K$ be a number field. A $K$-derived polynomial $f(x) \in K[x]$ is a polynomial that factors into linear factors over $K$, as do all of its derivatives. Such a polynomial is said to be proper if its roots are distinct. An unresolved question is whether or not there exists a proper $\mathbb{Q}$-derived polynomial of degree 4. In the search for a proper $\mathbb{Q}$-derived quartic emerged quadratic fields $K$ over which there exist proper $K$-derived quartics. Examples are known of proper $K$-derived quartics for a quadratic number field $K$, though other than $\mathbb{Q}(\sqrt{3})$, these fields have quite large discriminant. (The second known field is $\mathbb{Q}(\sqrt{3441})$.) The search finds examples for $K= \mathbb{Q}(\sqrt{D})$ with $D=\ldots,-95,-41,-19,21,31,89, \ldots$.