NON-HYPERELLIPTIC MODULAR CURVES OF GENUS 3

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Abstract. A curve $C$ defined over $\mathbb{Q}$ is modular of level $N$ if there exists a non-constant morphism $X_1(N) \to C$ defined over $\mathbb{Q}$ for some positive integer $N$. We present an algorithm to compute explicitly equations for modular non-hyperelliptic curves defined over $\mathbb{Q}$ of genus 3. Let $C$ be a modular curve of level $N$, we say that $C$ is new if the corresponding morphism between $J_1(N)$ and $\text{Jac}(C)$ factorizes through the new part of $J_1(N)$. We compute equations of 44 non-hyperelliptic new modular curves of genus 3, that we conjecture to be the complete list of this kind of curves. Furthermore, we describe some aspects of non-new modular curves.