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The requirement that students understand what they are doing and not just memorize procedures (rote learning) has been the leading educational principle since at least 1945. But consecutive reforms based on this principle have not produced the expected results. The problem may lie in the algorithms that are taught in schools. They were designed to be used in an automatic way by human computers, and to be efficient and verifiable, but not to be easy to understand. We will describe alternative algorithms for addition, subtraction, and multiplication based on Napier's work on location numbers in his *Rabdology*, and an algorithm for division based on an approximation method used by Brahmagupta. These algorithms are designed on clear mathematical principles, and require that a user make some decisions that depend on the specific numbers involved in the computation. And because these algorithms require a user's decisions, they are not routine and cannot be executed in an automatic way. The algorithms are less efficient than the standard ones, but sufficient for all numbers within the range that is covered in elementary and middle grades. (Received August 23, 2013)