Abstract Submitted
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A completely algebraic derivation of the simple harmonic oscillator wavefunction[1] JAMES FREERICKS, MICHAEL RUSHKA, Georgetown University — Introductory quantum mechanics instruction suffers from over emphasizing the coordinate-space representation and the need for differential equations. Learning how to solve each new problem brings in yet another mathematical technique to be employed (and most of these methods do not train students for future research work in quantum mechanics, which relies more heavily on operator-based methods). Do things need to be this way? No! We illustrate this point with a full algebraic derivation of the wavefunctions of the simple harmonic oscillator in coordinate space. This derivation is completely representation-independent, helping students understand the general principles of quantum mechanics. It is also simple to incorporate into the undergraduate curricula. The derivation begins with the standard approach that was first presented by Dirac in 1947 (and is modified slightly in the spirit of the Schrödinger factorization method), and then supplements it by employing the translation operator to determine the wavefunctions algebraically, without any differential equations.

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