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The authors study orthogonal polynomials on $[0, +\infty)$ with respect to an inner product involving derivatives that cannot be derived from a weight function. These polynomials can be written as a ${}_3F_3$ hypergeometric series and they satisfy a second-order differential equation and a five term recurrence relation. At most one zero of each polynomial is located outside $(0, +\infty)$, the interior of the interval of orthogonality. As a special case Koornwinder's Laguerre polynomials $\{L_n^{\alpha, M}(x)\}_{n=0}^{+\infty}$ are included.

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