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### Symmetry Lie algebras of $n$ th order ordinary differential equations

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#### Abstract

We show that an  $n$ th ( $n \geq 3$ ) order linear ordinary differential equation has exactly one of  $n + 1$ ,  $n + 2$ , or  $n + 4$  (the maximum) point symmetries. The Lie algebras corresponding to the respective numbers of point symmetries are obtained. Then it is shown that a necessary and sufficient condition for an  $n$ th ( $n \geq 3$ ) order equation to be linearizable via a point transformation is that it must admit the  $n$  dimensional Abelian algebra  $nA_1 = A_1 \oplus A_1 \oplus \dots \oplus A_1$ . We discuss in detail the symmetry realizations of  $(n - 1)A_1 \oplus A_1$ . Finally, we prove that an  $n$ th ( $n \geq 3$ ) order equation  $q^{(n)} = H(t, q, q', q^{n-1})$  cannot admit exactly an  $n + 3$  dimensional algebra of point symmetries which is a subalgebra of  $nA_1 \oplus \mathfrak{gl}(2, \mathbb{R})$ .





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