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Roots and all: an economical algorithm.

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From the text: Every polynomial of degree n can be expressed as a product of factors. It is possible to find identities relating the sums of the powers of the roots defined by $s_i = \sum_j (\alpha_j)^i i = 1, 2, 3, \dots,$ to the coefficients, ω_j, of the monic polynomial, without actually finding the roots α_k explicitly. It is straightforward to find recursion relations linking ω_i and s_i. We can then use the recursion relations to obtain s_i as functions of ω_1, ω_2, ... , ω_i as functions of s_1, s_2, ... , s_i. The process is laborious. We now describe a more economical way to obtain these expressions for ω_i.

Classification: H20 H70

Keywords: monic polynomials; coefficients; sums of powers of roots; identities; recursion relations; simultaneous linear equations; partition function; number of integer solutions; difference equations; partial derivatives; integrals; algebra