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Recurrences and Legendre Transform

Abstract. A binomial identity which relates to the famous Apéry numbers and the sums of cubes of binomial coefficients (for which Franel has established a recurrence relation almost one hundred years ago) can be seen as a particular instance of a Legendre transform between sequences. A proof of this identity can be based on the more general fact that the Apéry and Franel recurrence relations themselves are conjugate via Legendre transform. This motivates a closer look at conjugacy of sequences satisfying linear recurrence relations with polynomial coefficients. The role of computer-aided proof and verification in the study of binomial identities and recurrence relations is illustrated, and potential applications of conjugacy in diophantine approximation are mentioned.

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