

HIDDEN ALGEBRAIC STRUCTURES IN EXPANSIONS RELATING TO AIRY, BESSEL AND PAINLEVÉ FUNCTIONS

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Recent work on the asymptotic expansion of the hard-to-soft transition limit in random matrix theory has revealed unexpected algebraic structures relating to Airy, Bessel and Painlevé Functions: e.g., divisibility properties of certain polynomials relating to Olver’s asymptotic expansion of Bessel functions of large order in the transition region, or expansion terms of operator determinants (tau functions of Painlevé equations) being linear combinations of higher order derivatives of the Tracy-Widom distributions with rational polynomial coefficients. So far, all these structures were found only algorithmically based on CAS software, or in parts only numerically, by inspecting the first few (say, 10 to 100) accessible concrete cases. Proofs will be challenging, since these structures must be related to some underlying “integrability”.