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Circle and Divisor Problems, Bessel Function Series, and Associated Riesz
and Logarithmic Means

A page in Ramanujan's lost notebook contains two identities for trigonometric sums in terms of doubly infinite series of Bessel functions. One is related to the famous "circle problem" of Gauss and the other to the equally famous "Dirichlet divisor problem." Proofs of Ramanujan's identities under different interpretations are discussed. Our work leads to new analogues of these famous problems, as well as generalizations to Riesz means and analogous identities for logarithmic means. The research to be described is joint work with Sun Kim and Alexandru Zaharescu.