

## Partition identities for $k$ -regular partitions with distinct parts

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**Abstract:** We start with a little-known Euler type theorem (due to Alladi) which is the following: The number of partitions of  $n$  into distinct parts not divisible by  $k$  (i.e.  $k$ -regular partitions with distinct parts) equals the number of partitions of  $n$  into odd parts none repeated more than  $k - 1$  times.  $k = 1$  and  $2$  are tautologies.  $k = 3$  plays a prominent role in Schur's 1926 partition theorem. Both Alladi and Schur have further partition identities related to  $k = 2$  which we will discuss. Obviously,  $k = \infty$  is Euler's theorem. We then proceed to  $k = 4$  where an empirical investigation leads to a result for overpartitions. We conclude with a proof of the  $k = 4$  case and look at results and possibilities for  $k > 4$ .