

# The Abel Lemma and the $q$ -Gosper Algorithm

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**Abstract:** Chu has recently shown that the Abel lemma on summations by parts can serve as the underlying relation for Bailey's  ${}_6\psi_6$  bilateral summation formula. In other words, the Abel lemma spells out the telescoping nature of the  ${}_6\psi_6$  sum. We present a systematic approach to compute Abel pairs for bilateral and unilateral basic hypergeometric summation formulas by using the  $q$ -Gosper algorithm. It is demonstrated that Abel pairs can be derived from Gosper pairs. This approach applies to many classical summation formulas.

**AMS Classification:** 33D15, 33F10.

**Keywords:** the Abel lemma, Abel pairs, basic hypergeometric series, the  $q$ -Gosper algorithm, Gosper pairs.

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