

# Antiferromagnetic Heisenberg model with anisotropic coupling between nearest and next-nearest neighbors

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We introduce an approximate analytic solution for the  $S=1/2$  one-dimensional antiferromagnetic Heisenberg model with coupling between nearest- and next-nearest-neighbor spins. Closed-form expressions for the ground state, its energy, and the excitations are obtained. The range of validity of the analytic approach is determined by comparing with numerical computations. Excellent agreement is obtained in a wide region of the parameter space. © 1991 The American Physical Society.