



# Characterization of real inner product spaces by Hermite–Hadamard type orthogonalities

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## Abstract

In this study, we provide some new characterizations of the real inner product spaces using the notion of Hermite–Hadamard (HH) type orthogonalities and by considering their relationships with Birkhoff–James orthogonality. In addition, we investigate the classes of linear mappings that preserve two special types of these orthogonalities. In particular, we show that every HH-I-orthogonality preserving linear mappings is necessarily a scalar multiple of a linear isometry. Finally, we present some other characterizations of real inner product spaces in terms of HH-P- and HH-I-orthogonality preserving mappings.

## Keywords

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Birkhoff–James orthogonality; Carlsson orthogonality; Characterization of inner product spaces; Hermite–Hadamard type orthogonality; Orthogonality preserving mapping

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