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8. Analysis

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On higher order Hardy inequality The Hardy inequality $\int_\Omega |u(x)|^p d(x)^{-p} dx \leq c \int_\Omega |\nabla u(x)|^p dx$ with $d(x) = \operatorname{dist}(x, \partial\Omega)$ holds for $u \in C_0^\infty(\Omega)$ if $\Omega \subset \mathbb{R}^n$ is an open set with a sufficiently smooth boundary and if $1 < p < \infty$. P. Hajłasz proved the pointwise counterpart to this inequality involving a maximal function of Hardy-Littlewood type on the right hand side and, as a consequence, obtained the integral Hardy inequality. We extend these results for gradients of higher order and also for $p = 1$.