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*A nonlinear equation induced by fractional  $p$ -convexity*

In our study of the connection between fractional convexity and the fractional  $p$ -Laplace operator, we derive a nonlocal and non-linear equation. We begin by proving the existence and uniqueness of the viscosity solution to this equation. Subsequently, we demonstrate that  $u(x)$  is a viscosity sub-solution of the equation if and only if  $u(x)$  possesses the property of  $(\alpha, p)$ -convexity. Finally, we characterize the viscosity solution of this equation as the envelope of an  $(\alpha, p)$ -convex sub-solution. Our approach leverages the attainability of the exterior data and a comparison principle for the nonlocal, nonlinear equation.