On critical points of solutions of semilinear elliptic problems

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We are interested in qualitative properties of solutions of the semilinear elliptic problem

$$-\Delta u = f(u) \quad \text{in } \Omega, \qquad u = 0 \quad \text{on } \partial\Omega,$$

where $\Omega \subseteq \mathbb{R}^N$, $N \geq 2$ is a smooth and bounded domain and $f : \mathbb{R} \to \mathbb{R}$ is a smooth function. In particular we want to focus on the number of critical points of u and to investigate the role of the convexity of the domain Ω. If u is positive we discuss some generalization of existing results involving the sign of the curvature of $\partial\Omega$. Finally if u is a sign-changing solution one can prove that the second eigenfunction of the Laplacian admits exactly two critical points if Ω is a planar, convex and its eccentricity is large enough.
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