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Let F be a real polynomial of degree N . Then the curvature of F is defined to be

$$\kappa = \frac{F''}{(1 + (F')^2)^{\frac{3}{2}}}.$$

Determining the maximum number of zeros of κ is an easy problem: since the zeros of κ are the zeros of F'' , the curvature of F is 0 at most $N - 2$ times. A much more intriguing problem is to determine the maximum number of relative extreme values for the function κ , or equivalently, determine the maximum number of zeros of κ' . In 2004 it was shown that if all the zeros of F'' are real, then F has at most $N - 1$ points of extreme curvature. We use level sets and auxiliary functions to study the zeros of the derivatives of these functions. We provide a partial solution to this problem, showing that F has at most $N - 1$ points of extreme curvature when F has only simple zeros and when certain geometrical conditions hold. (Received September 06, 2012)