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Growth of a Polynomial not Vanishing in a Disk

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Abstract— *A well known result due to Ankeny and Rivlin states that if* $P(z) = \sum_{J=0}^{n} a_j z^j$ *is a polynomial of degree n with no zeros in* $|z| < 1$, *then for* $R \geq 1$,

$$\max_{|z|=R} |P(z)| \leq \frac{R^n + 1}{2} \max_{|z|=1} |P(z)|.$$

Recently, Jain obtained a generalization of the above inequality by considering polynomials with no zeros in $|z| < k, k \geq 1$ *and has simultaneously taken into consideration the sth derivative* $(0 \leq s < n)$ *of the polynomial, instead of the polynomial itself and proved*

$$\max_{|z|=R} |P^s(z)| \leq \frac{1}{2}\left\{\frac{d^s}{d\boldsymbol{R}^s}(R^n + k^n)\right\}\left(\frac{2}{1+k}\right)^n \max_{|z|=1} |P(z)|, \quad for \ R \geq k.$$

In this paper, we generalize as well as improve upon the above inequalities and other related results.

Keywords: *Polynomial, Maximum Modulus Principle, Zeros.*

2010 *MSC*: 30*A*10, 30*C*10, 30*C*15. }

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