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Stachó, L.L.

Direct approach to Laurent expansions. (English)

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http://www.cwi.nl/cwi/publications$_{b}ibl/NAW/cwi_{n}aw.html$

Let f be a holomorphic function on $A = \{z : r < |z| < \mathbb{R}\}$. Avoiding the use of the Cauchy integral formula and contour integrals, but adding the hypothesis that the derivative of f is bounded on A, the author obtains the Laurent series expansion of f on A. Lebesgue's dominated convergence theorem is used twice in the proof. Its first use is to obtain a formula for $f(z)$ as a limit of integrals, while its second application shows that the coefficients are independent of ρ in $(r, \mathbb{R})$. The paper concludes with a sketch of how to use Goursat's theorem to relax the hypothesis of local boundedness of the derivative.

F.W.Carroll (Columbus / Ohio)

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