When does a formal finite-difference expansion become "real"?

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Let $\Delta f(x) = f(x+1) - f(x)$. A basic finite difference operational calculus formula states that $\Delta^n f(x) = (e^D - 1)f(x)$ where $D = \frac{d}{dx}$ is understood in a formal manner. We show that such formula becomes possible when applied to slow growth meromorphic functions in $\mathbb{C}$. We then applies this result to give estimates to entire solutions of slower growth to linear difference equations with polynomial coefficients. This is a join work with Shao-Ji Feng.