

$$f_{N-2}(N^m x) = \frac{x^{N-1} e^{Nm} \sqrt{N}}{(2\pi)^m} \int_0^{N^{\tilde{\delta}}} dt e^{-t\sqrt{N}(x-r_N^m)} \\ \times \int_{[-\epsilon, \epsilon]^m} \left(\prod_{j=1}^m d\theta_j e^{-\frac{N}{2}\theta_j^2 + iN(r_N-1)\theta_j + it\sqrt{N}r_N^m\theta_j} \right) e^{NO(\vec{\theta}^3) + N^{\frac{1}{2}-\delta}O(\vec{\theta}^2) + O(t\sqrt{N}\vec{\theta}^2)} (1 + O(N^{-\delta})),$$