Let X be large and H also large but slightly smaller, and consider n ranging from 1 to X. For an arithmetic function $f(n)$ like the k-fold divisor function, what is the best mean square approximation of $f(n)$ by a restricted divisor sum (a function of the sort $\sum_{d|n,\, d<H} a_d$)? I hope to explain some of the context around this question and how the answer is connected to random matrix integrals over the unitary group.