iii) $\mathbb{E}[V_i V_{i+N}] = \frac{1}{N^2}\mathbb{E}\left[\sum_{K=i}^{i+N-1}\sum_{j=i+N}^{i+2N-1} V[KT]V[jT]\right]$

$= \frac{1}{N^2}\sum_{K=i}^{i+N-1}\sum_{j=i+N}^{i+2N-1}\mathbb{E}[V(KT)V(jT)]$

$= \frac{1}{N^2}\sum_{K=i}^{i+N-1}\sum_{j=N}^{2N-1}\mathbb{E}[V(KT)V((K+j)T)$

$= \frac{\sigma_n^2}{2\tau N^2}\sum_{K=i}^{i+N-1}\sum_{j=N}^{2N-1}\exp\left(-j\frac{T}{\tau}\right)$

$= \frac{\sigma_n^2}{2\tau N}\exp\left(\frac{-NT}{\tau}\right)\sum_{j=0}^{N-1}\exp\left(-j\frac{T}{\tau}\right)$

$= \frac{\sigma_n^2}{2\tau N}\exp\left(\frac{-NT}{\tau}\right)\left[\frac{1-\exp(-\frac{NT}{\tau})}{1-\exp(-T/\tau)}\right]\cdots$