Direct use of convolution theorem using elementary means \([e] \) 

\[
\mathcal{F}\left\{ \frac{n}{\pi} \sum_{\infty}^{1} R_{-r+q} f_{r} \right\} = \hat{\mathcal{F}}(k) \hat{F}(k) e^{-2\pi i k a} \]

Show: \( \hat{S}_k = \hat{F}(k) \hat{F}(k) \).

2. Property of FT under time translation \([e] \)

Say \( r(t) = s(t+\tau) \).

Given: \( \hat{s}(\omega) = \int_{-\infty}^{\infty} e^{-2\pi i \omega t} s(t) \, dt \).

Find: \( \hat{r}(\omega) \) in terms of \( \hat{s}(\omega) \).

3. Say: \( q(t) = \frac{d}{dt} s(t) \). Find: \( \hat{q}(\omega) \) in terms of \( \hat{s}(\omega) \) \([e] \).

(Describe anything you need about convergence.)

4. Moment: Write: \( \int s(t) \, dt \) in terms of \( \hat{s}(\omega) \).

(Describe anything you need about convergence.)