

- Generalize the power rule to distributions

$$\begin{aligned}\langle (\mathcal{F}t\mathcal{T}), \varphi \rangle &= \langle t\mathcal{T}, \mathcal{F}\varphi \rangle \\ &= \langle \mathcal{T}, t\mathcal{F}\varphi \rangle \\ &= \langle \mathcal{T}, \frac{1}{2\pi i} \mathcal{F}\varphi' \rangle \\ &= \langle \frac{\mathcal{T}}{2\pi i}, \mathcal{F}\varphi' \rangle \\ &= \langle \mathcal{F}[\frac{\mathcal{T}}{2\pi i}], \varphi' \rangle \\ &= - \langle \frac{d}{ds} \mathcal{F}[\frac{\mathcal{T}}{2\pi i}], \varphi \rangle\end{aligned}$$

$$\Rightarrow -2\pi i \mathcal{F}[t\mathcal{T}] = \frac{d}{dx} \mathcal{F}\mathcal{T}$$

or

$$-2\pi i t\mathcal{T} \Rightarrow \frac{d}{ds} \mathcal{F}\mathcal{T}$$