

(1) Theorem f piecewise smooth \Rightarrow

$$\int_{-L}^x f(x) dx = \text{Term-by-Term} \int_{-L}^x \text{integration of } \mathcal{P}_p \text{ Fourier series}$$

$$\begin{aligned} \int_a^b &= \int_a^x + \int_x^b \\ &= \int_a^x - \int_b^x \end{aligned}$$