D-3

$\operatorname{sign}(x) \quad [-1, 1) \Rightarrow \quad r = 2$

$$C_n = \frac{1}{2}\int_{-1}^{1} \operatorname{sign}(x)\, e^{-inx\pi}\, dx =$$

$$= -\frac{1}{2}\int_{-1}^{0} e^{-inx\pi}\, dx + \frac{1}{2}\int_{0}^{1} e^{-inx\pi} = -\frac{1}{2}\cdot\frac{1}{-in\pi} e^{-inx\pi}\Big|_{-1}^{0}$$

$$+ \frac{1}{2}\cdot\frac{1}{in\pi} e^{-inx\pi}\Big|_{0}^{1} = -\frac{1}{2}\left(\frac{e}{\pi in} - \frac{e}{n\pi} e^{en\pi}\right) +$$

$$+ \frac{1}{2}\left(\frac{e}{in\pi} e^{-en\pi} - \frac{e}{n\pi}\right) - \frac{e}{2\pi n} e^{in\pi} + \frac{e}{2n\pi} e^{-in\pi} \frac{e}{n\pi} =$$

$$= \frac{e}{n\pi}\cos(n\pi) - \frac{e}{n\pi} = \frac{e}{n\pi}\left(\cos(n\pi)-1\right)$$

$$f(x) = \sum_{-\infty}^{\infty} \frac{e}{n\pi}\left(x\cos(n\pi)-1\right) e^{in\pi x} = \sum_{-\infty}^{\infty} \frac{e}{n\pi}\left((-1)^n-1\right)$$

$$e^{inx\pi} = \sum_{-\infty}^{\infty} \frac{e}{\pi(2n+1)} \cdot e^{ix\pi(2n+1)}$$