Solutions to EE3210 Quiz 6 Problems

Problem 1: This signal is periodic with a fundamental period $T = 2$. To determine the Fourier series coefficients a_k, we use the analysis formula of the continuous-time Fourier series, and select the interval of integration to be $-1 < t < 1$. Within this interval, $x(t)$ is the same as $\delta(t)$. Thus, using the sampling property of $\delta(t)$, it follows that

$$a_k = \frac{1}{2}\int_{-1}^{1} \delta(t) e^{-jk\pi t} dt = \frac{1}{2}.$$

Problem 2: Given that this signal is periodic with a fundamental period $T = 2$, to determine the Fourier series coefficients a_k, we use the analysis formula of the continuous-time Fourier series, and choose $-1 < t < 1$ as the interval over which the integration is performed. Then, it follows that:

$$\begin{aligned} a_k &= \frac{1}{2}\int_{-1}^{1} e^{-t} e^{-jk\pi t} dt = \frac{1}{2}\int_{-1}^{1} e^{-(1+jk\pi)t} dt \\ &= -\frac{1}{2(1+jk\pi)} \left[e^{-(1+jk\pi)t} \right]_{-1}^{1} = -\frac{e^{-(1+jk\pi)} - e^{(1+jk\pi)}}{2(1+jk\pi)} \\ &= \frac{(-1)^k \left(e - e^{-1}\right)}{2(1+jk\pi)}. \end{aligned}$$