Foundations of Audio Signal Processing:

Exercise sheet 5

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Exercise 5.1.

(a).

$$||f(t)||_1 = \int_{-\infty}^{\infty} f(t)dt = \int_0^1 f(t)dt = \int_0^1 t^{-1/2}dt = \lim_{t\to 1} 2t^{1/2} - \lim_{t\to 0} 2t^{1/2} = 2 \tag{1}$$

$$||f(t)||_2 = \int_{-\infty}^{\infty} f(t)^2dt = \int_0^1 f(t)^2dt = \int_0^1 t^{-1}dt = \lim_{t\to 1} \ln(t) - \lim_{t\to 0} ln(t) = \infty \tag{2}$$

(b).

$$||f(t)||_1 = \int_{-\infty}^{\infty} f(t)dt = \int_0^{\infty} f(t)dt = \int_0^{\infty} t^{-1}dt = \lim_{t\to \infty} \ln(t) - \lim_{t\to 0} \ln(t) = \infty \tag{3}$$

$$||f(t)||_2 = \int_{-\infty}^{\infty} f(t)^2dt = \int_0^{\infty} f(t)^2dt = \int_0^{\infty} t^{-2}dt = \lim_{t\to \infty} (-\frac{1}{t}) - \lim_{t\to 0}(-\frac{1}{t}) = 0 + 1 = 1 \tag{4}$$