Exercise 5.101

L Answer (a).

The function $x_1(t) = \cos(10\pi t)$ has fundamental period

$$T_1 = \frac{2\pi}{10\pi} = \frac{1}{5}.$$

(*) fundamental period of $\cos(\alpha t)$ or $\sin(\alpha t)$ is $\frac{2\pi}{|\alpha|}$

The function $x_2(t) = \sin(5t)$ has fundamental period

$$T_2 = \frac{2\pi}{5}.$$

Computing T_1/T_2, we have

$$\begin{aligned}\frac{T_1}{T_2} &= \frac{\left(\frac{1}{5}\right)}{\left(\frac{2\pi}{5}\right)} \\ &= \left(\frac{1}{5}\right)\left(\frac{5}{2\pi}\right) \\ &= \frac{1}{2\pi}.\end{aligned}$$

Since T_1/T_2 is not rational, x is not periodic. Consequently, x does not have a Fourier series representation.

