a) Find the Fourier series for

\[ \frac{1}{T} \int_{-T}^{T} f(t) \, dt \] for the signal shown.

Then divide by \( \frac{1}{T} \) (integrate in time domain).

This signal can be expressed as \( \frac{1}{T} \left[ p(t) - p(t-T) \right] \) when \( p(t) \) is a pulse of duration \( T \).

\[ p(t) \leftrightarrow \frac{1}{T} e^{-j\frac{2\pi ft}{T}} \sin \frac{\pi t}{T} \]

\[ \frac{1}{T} \left[ p(t) - p(t-T) \right] \leftrightarrow \frac{1}{T} e^{-j\frac{2\pi ft}{T}} \sin \frac{\pi t}{T} \left[ 1 - e^{-j\frac{2\pi fT}{T}} \right] \]

\[ = \frac{j}{\pi fT} \sin \frac{\pi fT}{T} e^{j\frac{\pi fT}{T}} \left[ 1 - e^{-j\frac{2\pi fT}{T}} \right] \]

\[ = \frac{1}{\pi f} \sin \frac{\pi ft}{T} e^{j\frac{\pi ft}{T}} \left[ 1 - e^{-j\frac{2\pi fT}{T}} \right] \]

Fourier series for our signal:

\[ \frac{1}{2\pi k} \sin \frac{\pi ft}{T} e^{j\frac{\pi ft}{T}} \left[ 1 - e^{-j\frac{2\pi fT}{T}} \right] \]
b) Must have $Z(w) < 1$, else signal is unrecoverable.

c) Simple lowpass filter will recover $w(t)$. 