1. **Sampling**

   Assume $x(t)$ a real bandlimited signal where $X(j\omega)$ is non-zero for $|\omega| \leq 2\pi B$ rad/s. If F_s Hz is the Nyquist rate of $x(t)$, determine the Nyquist rate in Hz of the following signals in terms of B:

   (a) $x(t-1)$

   (b) $\cos(2\pi Bt)x(t)$

   (c) $x(t) + x(\frac{t}{2})$

2. **Denoising**

   Given the system in Figure 1 and the Fourier transforms in Figure 2, determine A and find the maximum value of T in terms of W such that $y(t) = x(t)$ if $s(t)$ is the impulse train

$$s(t) = \sum_{n=-\infty}^{n=\infty} \delta(t - nT)$$

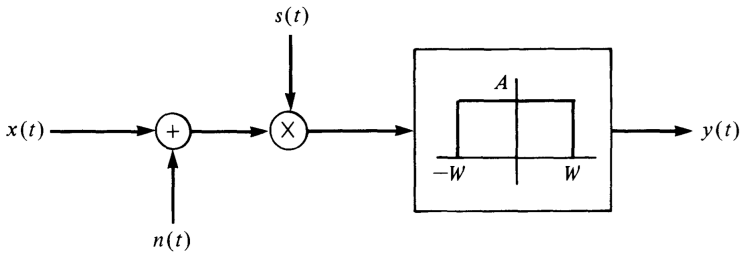

Figure 1: Denoising system

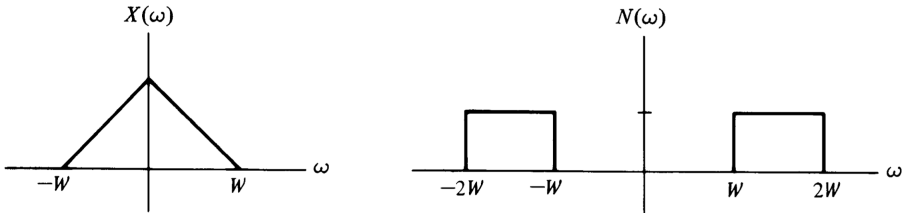

Figure 2: Fourier transforms

3. **Laplace transform**

Consider the signal $x(t) = 3e^{2t}u(t) + 4e^{3t}u(t)$

(a) Does the Fourier transform of this signal converge?

(b) For which of the following values of σ does the Fourier transform of $x(t)e^{-\sigma t}$ converge?

i. $\sigma = 1$

ii. $\sigma = 2.5$

iii. $\sigma = 3.5$

(c) Determine the laplace transform $X(s)$ of $x(t)$. Sketch the location of the poles and zeros of $X(s)$ and the ROC.