8.8

(a) $Y(j\omega) = \frac{j}{2}X(j(\omega+\omega_c)) - \frac{j}{2}X(j(\omega-\omega_c)) - \frac{j}{2}X(j(\omega+\omega_c)) + \frac{j}{2}X(j(\omega-\omega_c))$

$= 0$?

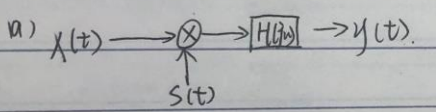
$Y(j\omega) = Y^*(-j\omega)$

$\therefore y(t)$ is real

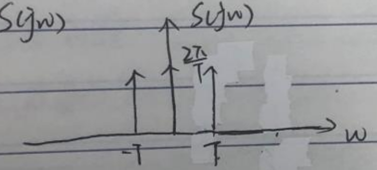
(b) Yes, because $\omega_c > \omega_m$.

8.24

(a)



S(jw)



$W(j\omega) = \frac{1}{2\pi}(X(j\omega) * S(j\omega))$

$= \frac{\omega_c}{2\pi}\sum_{k=-\infty}^{+\infty} X(j(\omega - k\omega_c))$ $\omega_c \to \frac{2\pi}{T}$

$Y(j\omega) = W(j\omega)\cdot H(j\omega)$

$= \frac{A\omega_c}{2\pi}[X(j\omega - j\omega_c) + X(j\omega + j\omega_c)]$

$\therefore y(t) = \frac{A\omega_c}{2\pi}x(t)\cdot\cos\omega_c t$ $\omega_c = \frac{2\pi}{T}$

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(b) $S(j\omega) = \frac{2\pi}{T}e^{-j\omega\Delta}\sum_{k=-\infty}^{+\infty}\delta(\omega - k\omega_c)$

$= \frac{2\pi}{T}\sum_{k=-\infty}^{+\infty}e^{-jk\omega_c\Delta}\delta(\omega - k\omega_c)$

$W(j\omega) = \frac{1}{2\pi}(X(j\omega) * S(j\omega))$

$= \frac{\omega_c}{2\pi}\sum_{k=-\infty}^{+\infty}e^{-jk\omega_c\Delta}X(j(\omega - k\omega_c))$

$Y(j\omega) = W(j\omega)\cdot H(j\omega)$

$= \frac{A\omega_c}{2\pi}[e^{-j\omega_c\Delta}X(j(\omega-\omega_c)) + e^{j\omega_c\Delta}X(j(\omega+\omega_c))]$

$y(t) = \frac{A\omega_c}{2\pi}x(t)\cos(\omega_c t - \omega_c\Delta)$

$\omega_c = \frac{2\pi}{T}$ $\theta_c = -\frac{2\pi}{T}\Delta$

(c) $\frac{2\pi}{T} + \omega_m \le \frac{3\pi}{T}$

$\therefore \omega_m \le \frac{\pi}{T}$

maximum allowable value for ω_m is $\frac{\pi}{T}$.

8.30.

(a). $p(t) = \sum_{n=-\infty}^{+\infty}\delta(t - nT)$

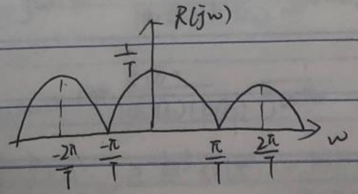
$P(j\omega) = \frac{2\pi}{T}\sum_{k=-\infty}^{+\infty}\delta(\omega - \frac{k2\pi}{T})$

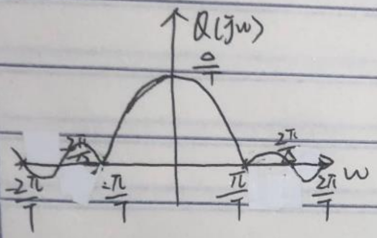
$R(j\omega) = \frac{1}{2\pi}(X(j\omega) * P(j\omega))$

$= \frac{1}{T}\sum_{k=-\infty}^{+\infty}X(j(\omega - \frac{2\pi}{T}k))$

$H(j\omega) = \frac{2\sin(\omega\cdot\frac{\Delta}{2})}{\omega}$

$Q(j\omega) = R(j\omega)\cdot H(j\omega) = \frac{2\sin(\omega\frac{\Delta}{2})}{\omega T}\sum_{k=-\infty}^{+\infty}X(j(\omega - \frac{2\pi}{T}k))$



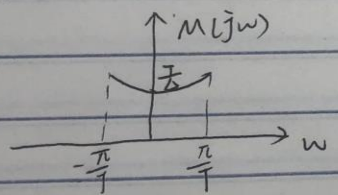


(b)

$$M(j\omega) = \begin{cases} \frac{\omega T}{2\sin(\frac{\omega T}{2})} & |\omega| < \frac{\pi}{T} \\ 0 & |\omega| \geq \frac{\pi}{T} \end{cases}$$

$\frac{2\pi}{\Delta} > \frac{\pi}{T}$ $\Delta < 2T$

(c)



8.35.

W(jω)

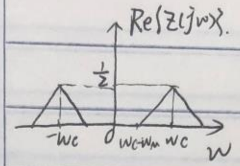
(a) $\cos\omega_c t \overset{F}{\longleftrightarrow} \pi[\delta(\omega-\omega_c)+\delta(\omega+\omega_c)]$

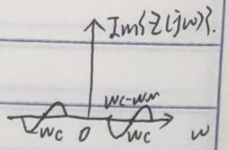
$Z(j\omega) = \frac{1}{2\pi}[(Re\{X(j\omega)\}+jIm\{X(j\omega)\}) * W(j\omega)]$

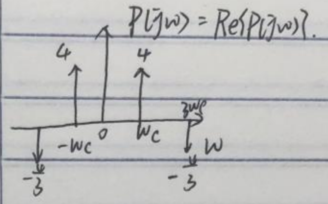
$= \frac{1}{2}[X(j(\omega-\omega_c)) + X(j(\omega+\omega_c))]$

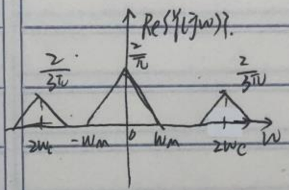
$P(j\omega) = \sum_{\substack{k \neq 0 \\ k=-\infty}}^{+\infty} \frac{4\sin(\frac{k\pi}{2})}{k}\delta(\omega - k\omega_0)$

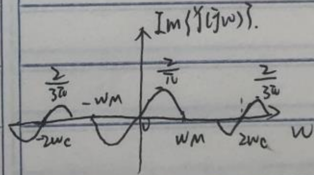
$Y(j\omega) = \frac{1}{2\pi}[Z(j\omega) * P(j\omega)]$











(b) $H(j\omega) = \begin{cases} \frac{\pi}{2} & |\omega| < \omega_m \\ 0 & \text{o.w.} \end{cases}$