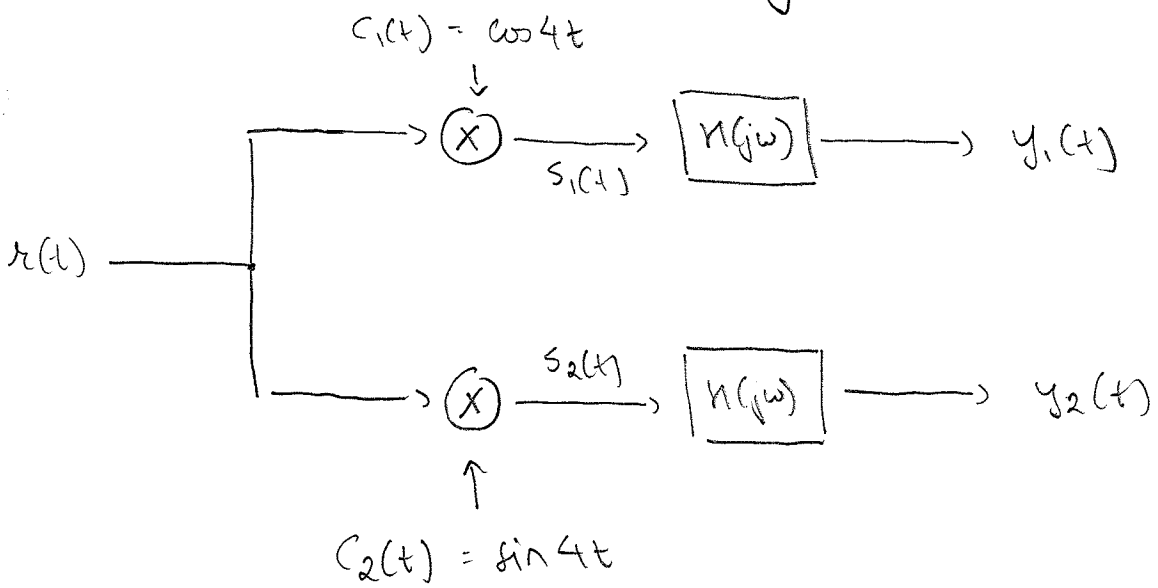
Demultiplexing System



8.) $s_1(t) = r(t) \cdot \cos(4t)$

$= \left[r_1(t) + r_2(t) \right] \cdot \cos(4t)$

$S_1(j\omega) = \left[R_1(j\omega) + R_2(j\omega) \right] * C(j\omega) \cdot \frac{1}{2\pi}$

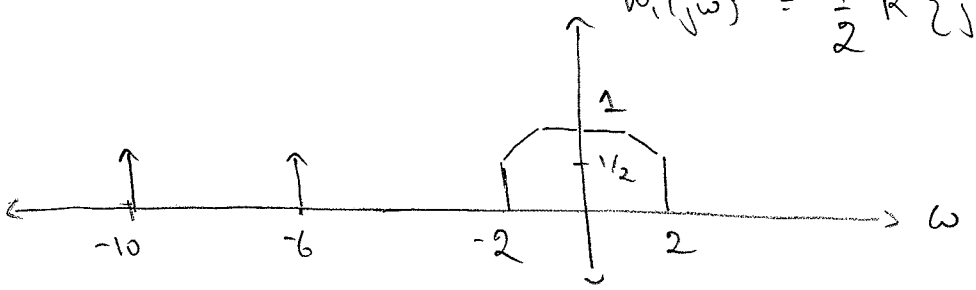
$= R(j\omega) * C(j\omega) \cdot \frac{1}{2\pi}$

$= \frac{1}{2\pi} \left[R(j\omega) * \pi \{ \delta(\omega - 4) + \delta(\omega + 4) \} \right]$

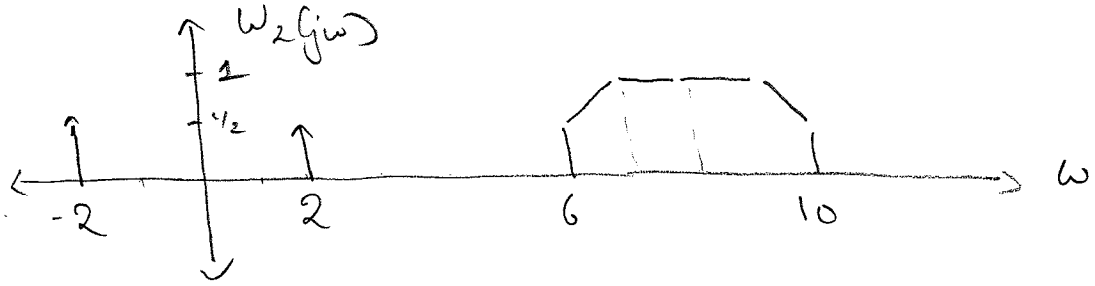
$= \frac{1}{2} \left[R\{ j(\omega - 4) \} + R\{ j(\omega + 4) \} \right]$

$= W_2(j\omega) + W_1(j\omega)$

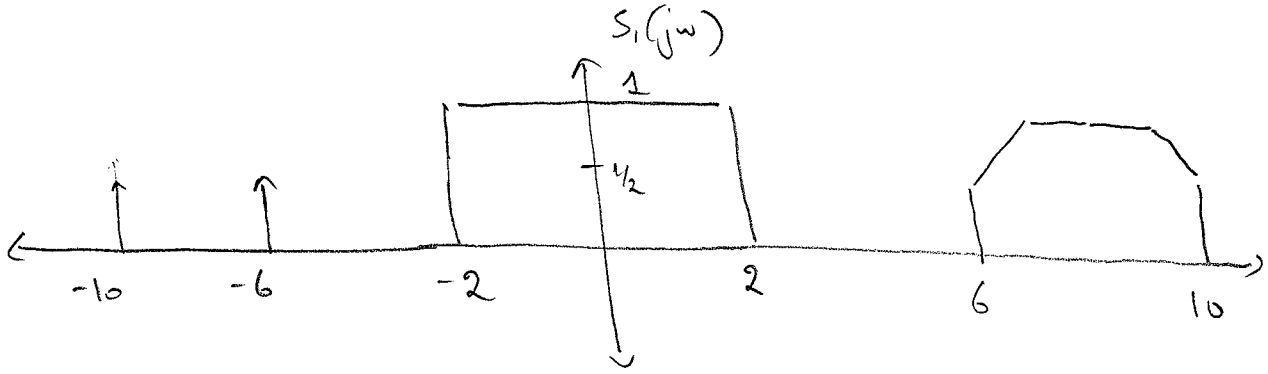
$W_1(j\omega) = \frac{1}{2} R\{ j(\omega + 4) \}$



$$W_2(j\omega) = \frac{1}{2} R\{j(\omega-4)\}$$



$$\therefore \quad S_1(j\omega) = W_1(j\omega) + W_2(j\omega)$$



9.) $$s_2(t) = r(t) \cdot c(t)$$

$$= \left[r_1(t) + r_2(t) \right] \cdot c(t)$$

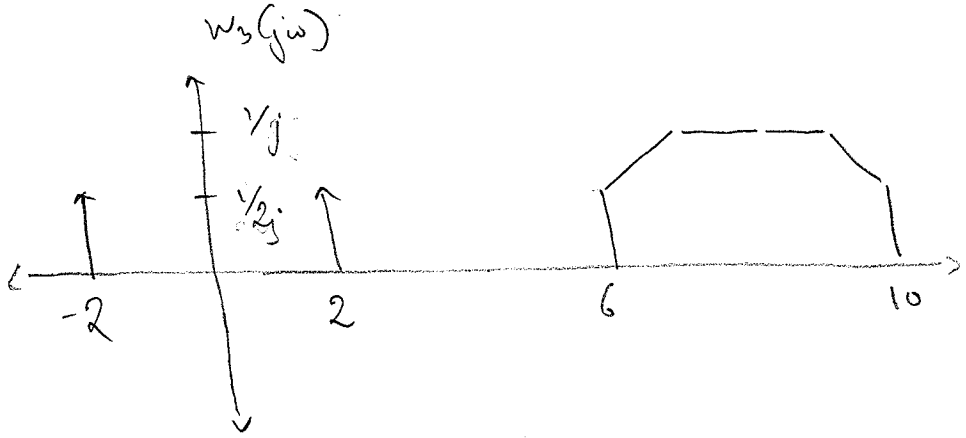
$$S_2(j\omega) = \left[R_1(j\omega) + R_2(j\omega) \right] * C(j\omega) \cdot \frac{1}{2\pi}$$

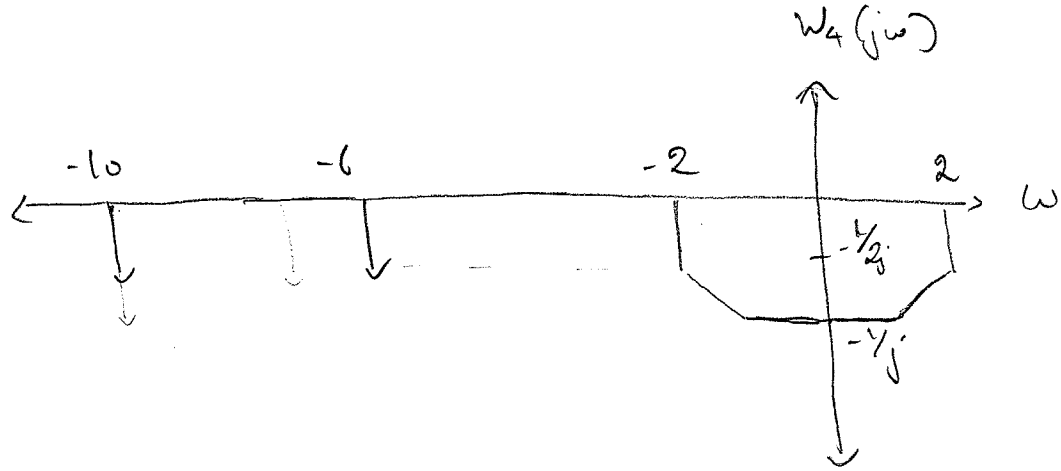
$$= \frac{1}{2\pi} \left[R(j\omega) * C(j\omega) \right]$$

$$= \frac{1}{2\pi} \left[R(j\omega) * \frac{\pi}{j} \left\{ \delta(\omega-4) - \delta(\omega+4) \right\} \right]$$

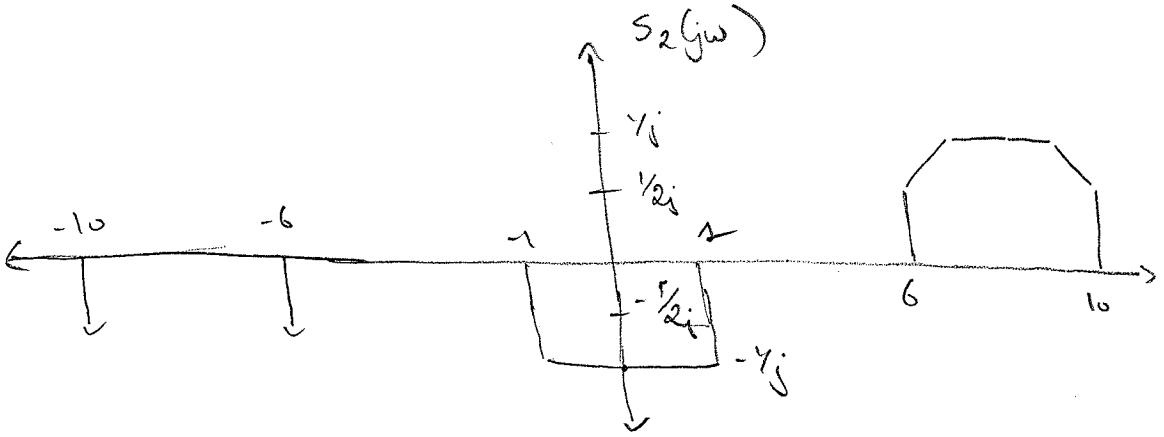
$$= \frac{1}{2j} R\{j(\omega-4)\} - \frac{1}{2j} R\{j(\omega+4)\}$$

$$= W_3(j\omega) - W_4(j\omega)$$



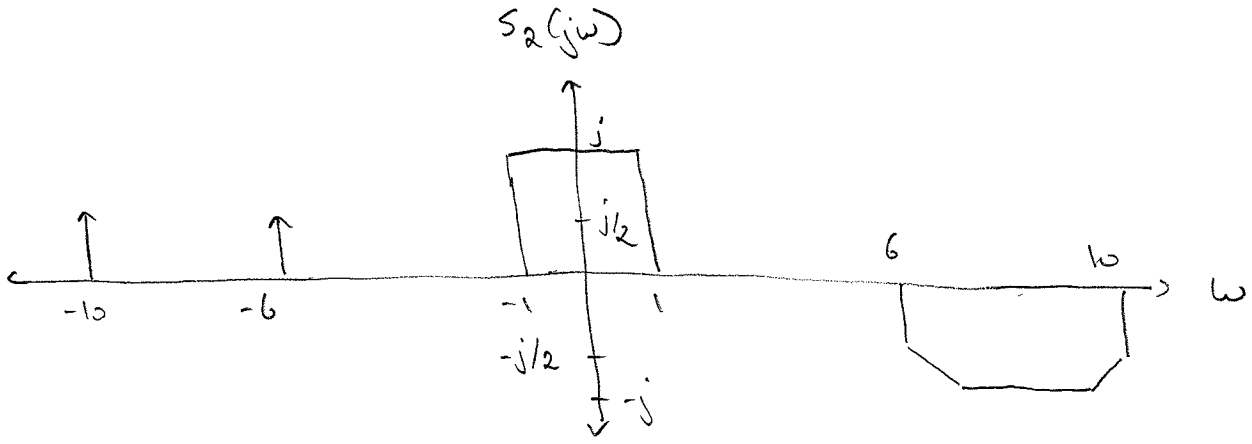


$$S_2(j\omega) = W_3(j\omega) - W_4(j\omega)$$



$1/j = -j$ $\qquad -1/j = j$

$1/2j = -j/2$ $\qquad -1/2j = j/2$



$\therefore$ $H(j\omega)$ = L.P.F. with gain 2 w/ $\omega_c = 4$

$c(t) = \cos 4t$ or $\sin 4t$ → (1)

$c(t) = \cos(\omega_c t)$ or $\sin(\omega_c t)$ → (2)

Comparing (1) & (2);

$\omega_c = 4$