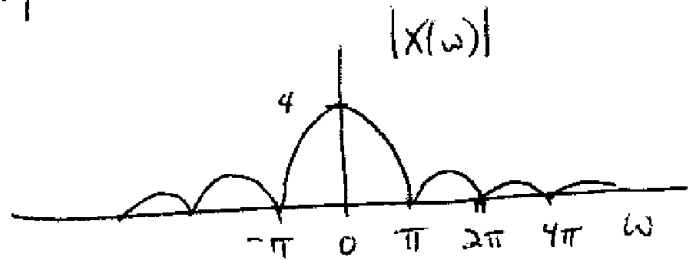


$$1. x(t) = 2 p_2(t-1)$$

$$X(\omega) = 2(2) \operatorname{sinc}\left(\frac{2\omega}{2\pi}\right) e^{-j\omega}$$

$$= 4 \operatorname{sinc}\left(\frac{\omega}{\pi}\right) e^{-j\omega}$$

$$|X(\omega)| = 4 \left| \operatorname{sinc}\left(\frac{\omega}{\pi}\right) \right|$$



$$2. x(t) = 3 p_2(t-3) + 3 p_2(t+3)$$

$$= 3 p_3(t) - 3 p_3(t)$$

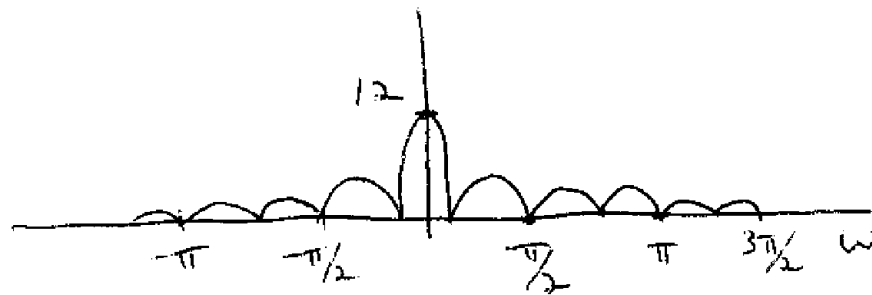
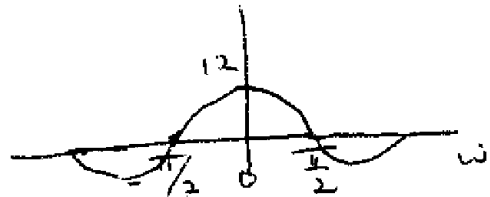
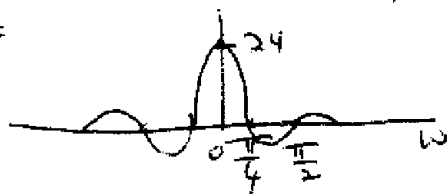
$$X(\omega) = 3(8) \operatorname{sinc}\left(\frac{8\omega}{2\pi}\right) - 3(4) \operatorname{sinc}\left(\frac{4\omega}{\omega\pi}\right)$$

$$= 24 \operatorname{sinc}\left(\frac{4\omega}{\pi}\right) - 12 \operatorname{sinc}\left(\frac{2\omega}{\pi}\right)$$

zero crossing at  $\frac{2\pi}{2} = \frac{\pi}{4}$

zero crossing at  $\frac{2\pi}{4} = \frac{\pi}{2}$

$|X| =$



$$3. \quad x(t) = t^2 p_4(t-2)$$

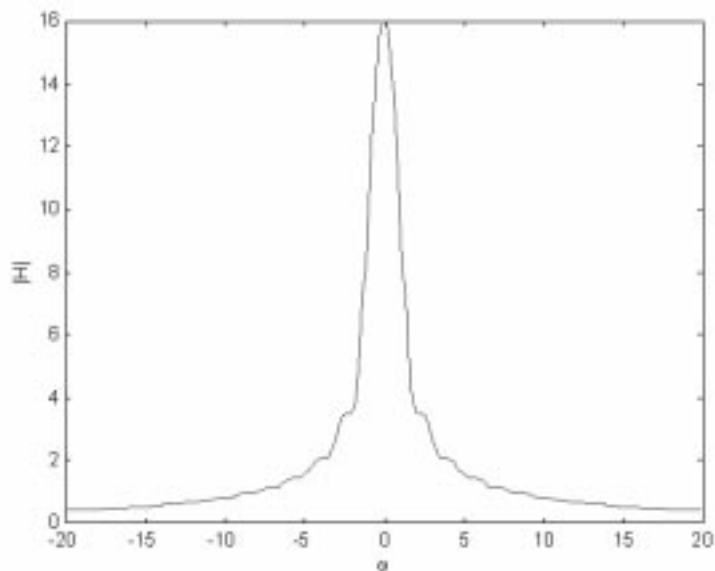
$$p_4(t-2) \longleftrightarrow 4 \operatorname{sinc}\left(\frac{2\omega}{\pi}\right) e^{-2j\omega}$$

$$2t p_4(t-2) \longleftrightarrow j 2 \frac{d}{d\omega} \left[ 4 \frac{\sin(2\omega)}{2\omega} e^{-2j\omega} \right]$$

$$= 4j \left[ \frac{\omega(2\cos(2\omega)e^{-2j\omega} - 2j \sin(2\omega)e^{-2j\omega})}{\omega^2} - \frac{\sin(2\omega)e^{-2j\omega}}{\omega^2} \right]$$

$$= \frac{4j}{\omega^2} e^{-2j\omega} (\omega 2 \cos(2\omega) - 2j\omega \sin(2\omega) - \sin(2\omega))$$

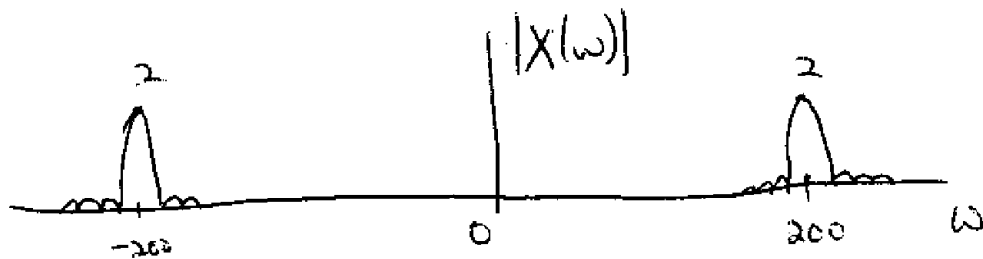
$$= \frac{4j}{\omega^2} e^{-2j\omega} (\omega 2 e^{-2j\omega} - \sin(2\omega))$$



$$4: x(t) = \cos(200t) p_4(t)$$

$$p_4(t) \longleftrightarrow 4 \operatorname{sinc}\left(\frac{2\omega}{\pi}\right)$$

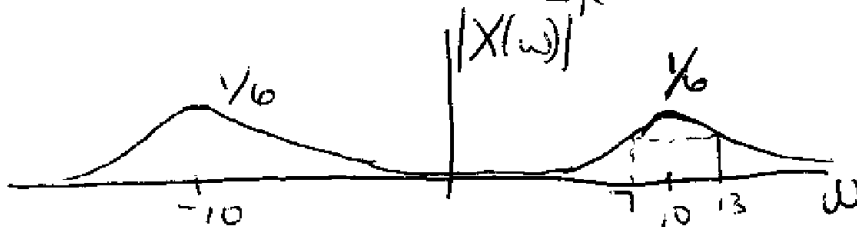
$$\cos(200t) p_4(t) \longleftrightarrow 2 \operatorname{sinc}\left(\frac{2}{\pi}(\omega - 200)\right) + 2 \operatorname{sinc}\left(\frac{2}{\pi}(\omega + 200)\right)$$



$$5: x(t) = e^{-3t} \cos(10t) u(t)$$

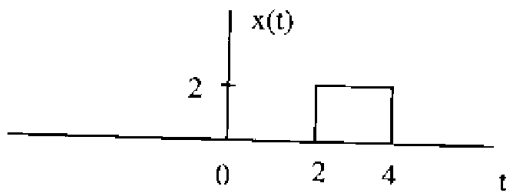
$$e^{-3t} u(t) \longleftrightarrow \frac{1}{\omega + 3}$$

$$e^{-3t} u(t) \cos(10t) \longleftrightarrow \frac{1}{2} \left[ \frac{1}{\omega - 10 + 3} + \frac{1}{\omega + 10 + 3} \right]$$



6.

a)

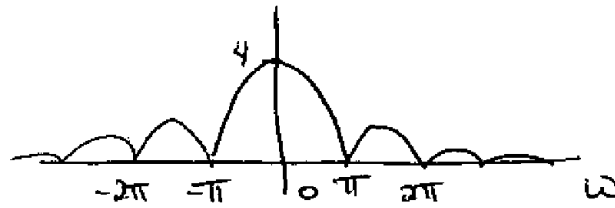


b)  $x(t) = 2e^{-2t}u(t)$

c)  $x(t) = 5e^{-5t}u(t)$

d)  $x(t) = e^{-2t}\cos(4t)u(t)$

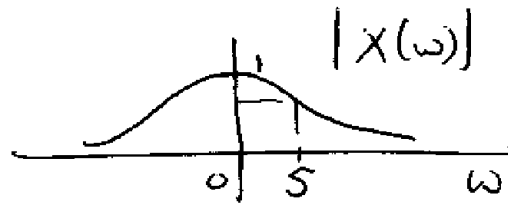
a)  $x(t) = 2\rho_2(t-3) \leftrightarrow 4 \operatorname{sinc}\left(\frac{\omega}{2\pi}\right) e^{-3j\omega} = X(\omega)$



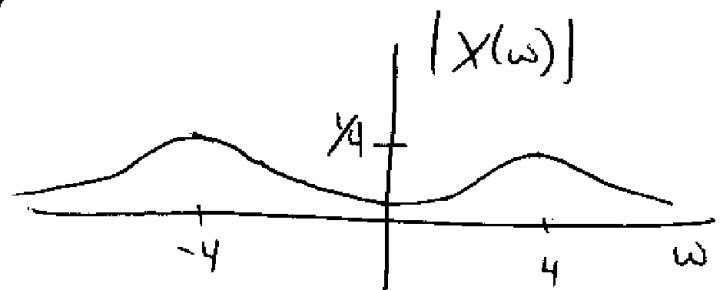
b)  $X(\omega) = \frac{2}{2+j\omega}$



c)  $X(\omega) = \frac{5}{5+j\omega}$

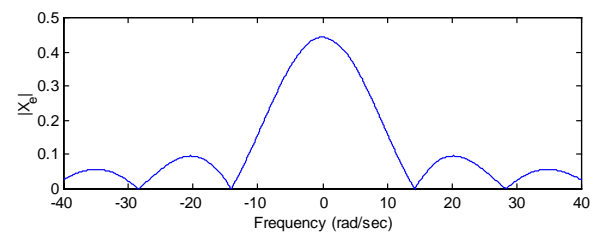
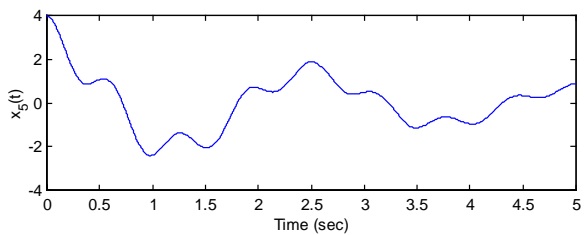
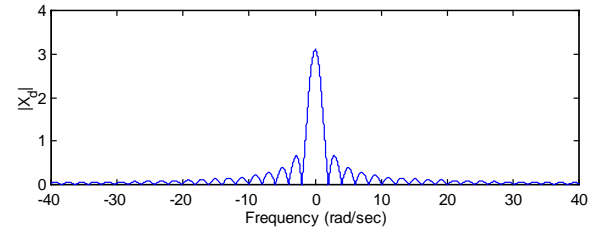
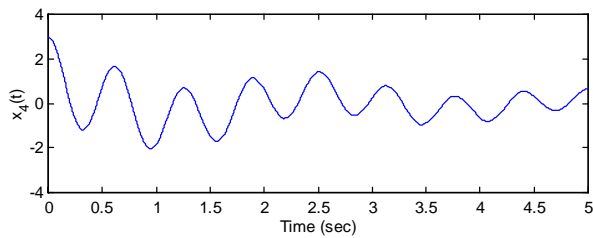
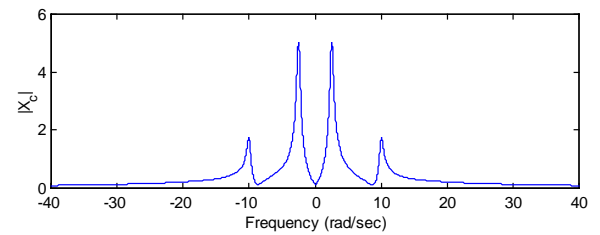
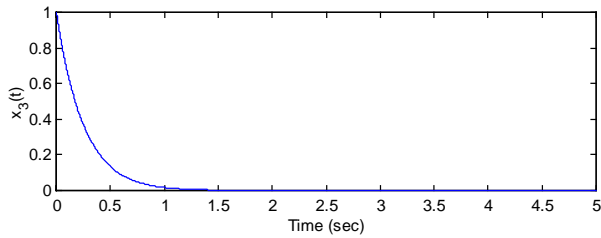
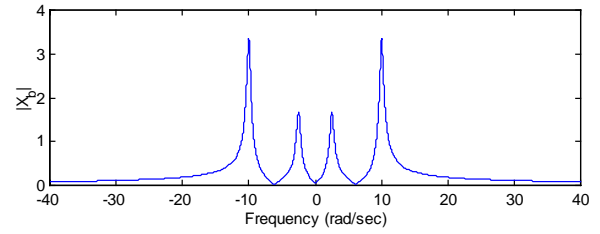
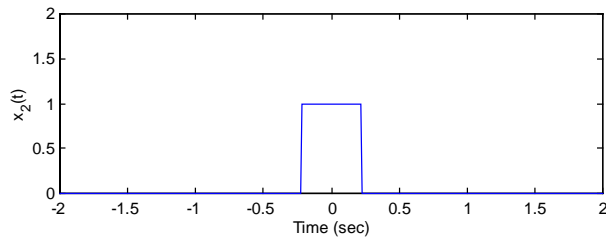
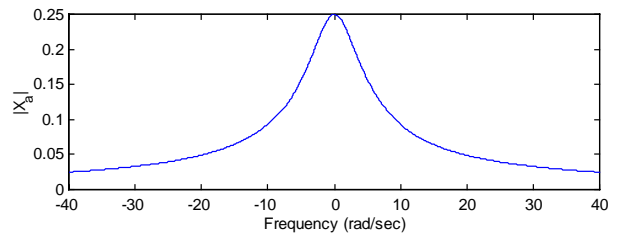
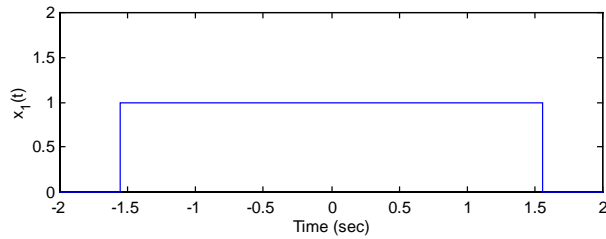


d)  $X(\omega) = \frac{1}{2} \left[ \frac{1}{j(\omega-4)+2} + \frac{1}{j(\omega+4)+2} \right]$

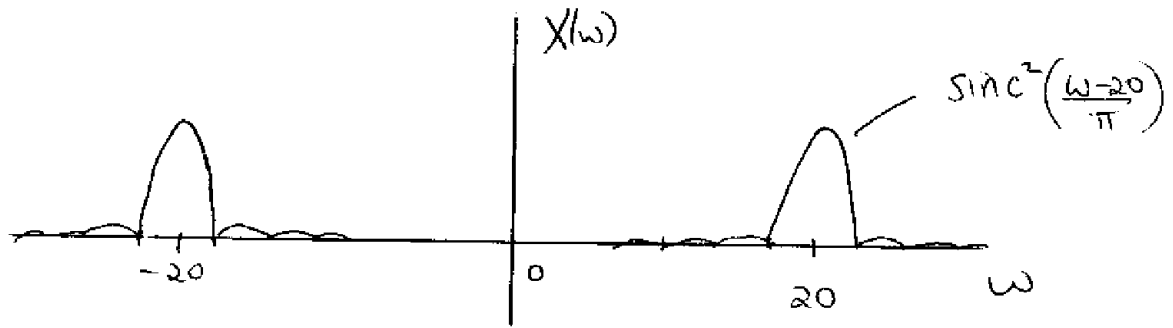


7. Match the time responses with the corresponding frequency responses.

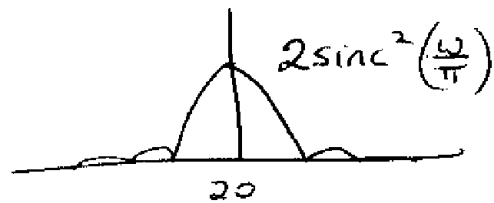
1.   d      2.   e      3.   a      4.   b      5.   c  



8.



Consider  $X_1(\omega)$



$$x_1(t) = \left(1 - \frac{2|t|}{4}\right) p_4(t)$$

$$\text{then } x(t) = x_1(t) \cos(20t)$$