Serie 2.

1) $\frac{1}{(1+iw)^2} = \frac{1}{(1+iw)} \cdot \frac{1}{(1+iw)}$.

$\mathcal{F}\{f(t) * g(t)\} = \hat{f}(w)\hat{g}(w)$

$\mathcal{F}^{-1}\left(\frac{1}{(1+iw)^2}\right) = H(t)e^{-t} * H(t)e^{-t}$

2. $\frac{\sin 3w}{w(2+iw)} = \frac{\operatorname{sen} 3w}{w} \cdot \frac{1}{2+iw}$

$\mathcal{F}^{-1}\left\{\frac{\operatorname{sen}(3w)}{w} \cdot \frac{1}{2+iw}\right\} =$

$\mathcal{F}^{-1}\left\{\frac{1}{2}\left(\frac{2}{w}\operatorname{sen}(3w)\right) \cdot \frac{1}{2+iw}\right\} =$

$(H(t+3) - H(t-3)) * H(t)e^{-2t}$

Serie #4.

$$\int_{-\infty}^{\infty} |f(t)|^2 \, dt. \qquad f(t) = H(t)\, e^{-2t}$$

$$\int_0^{\infty} e^{-4t} \, dt = \frac{-e^{-4t}}{4}\Big|_0^{\infty} = \frac{1}{4}$$

Quiz #3.

$$y'' + 6y' + 5y + \delta(t-3)$$

$$\mathcal{F}\{y'' + 6y' + 5y\} = \mathcal{F}\{\delta(t-3)\}$$

$$(i\omega)^2 \hat{y}(\omega) + 6(i\omega)\hat{y}(\omega) + 5\hat{y} = e^{-i\omega 3}$$

$$\hat{y}(\omega)\left[(i\omega)^2 + 6(i\omega) + 5\right] = e^{-i\omega 3}$$

$$\hat{y}(\omega) = \frac{e^{-i\omega 3}}{\left[(i\omega)^2 + 6(i\omega) + 5\right]} = \frac{e^{-i\omega 3}}{(i\omega+1)(i\omega+5)}$$

$$y(t) = \mathcal{F}^{-1}\left\{\frac{e^{-i\omega 3}}{(1+i\omega)} \cdot \frac{1}{(i\omega+5)}\right\}$$

$$y(t) = H(t-3)e^{-(t-3)} * H(t)e^{-5t}$$

2) $2u(t)te^{-2t}$

$$2u\,\mathcal{F}\{t\,u(t)e^{-2t}\} = 2u\left(i\frac{d}{dw}\frac{1}{2+iw}\right)$$

$$= 2u\left(i\frac{d}{dw}(2+iw)^{-1}\right) = 2ui\left(-1(2+iw)^{-2}(i)\right)$$

$$= -2ui^2(2+iw)^{-2} = 2u(2+iw)^{-2}$$

3. $\frac{d}{dt}\left(u(t)e^{-3t}\right)$

$$\mathcal{F}\left\{\frac{d}{dt}\left(u(t)e^{-3t}\right)\right\} = iw\,\frac{1}{3+iw}$$

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16004336 AN Mate 6.

1. $\underbrace{3t}_{t^n}\underbrace{e^{-9|t|}}_{f(t)} = 3\left[i \frac{d}{dw} \hat{f}(w) \right]$

$\mathcal{F}\{e^{-9|t|}\} = \frac{2(9)}{(81)+w^2}$

$= 3\left[i \frac{d}{dw}\left(\frac{18}{81+w^2} \right)\right] = 3\left[i \frac{d}{dw}\left(18(81+w^2)^{-1} \right)\right]$

$= 54 i \frac{d}{dw}(81+w^2)^{-1} = -54 i (81+w^2)^{-2}(2w)$

$= -108 i (81+w^2)^{-2}(w)$