1)

a.

$$f(t)=\begin{cases} -At-2A & -2\le t<-3/2 \\ At+A & -3/2\le t<0 \\ -At+A & 0\le t<\frac{3}{2} \\ At-2A & \frac{3}{2}\le t\le 2 \end{cases}$$

$$\mathcal{F}[f(t)]=\int_{-2}^{-3/2}(-At-2A)e^{-iwt}dt+\int_{-3/2}^{0}(At+A)e^{-iwt}dt+$$

$$\int_{0}^{3/2}(-At+A)e^{-iwt}dt+\int_{3/2}^{2}(At-2A)e^{-iwt}dt$$

$$=-A\int_{-2}^{-3/2}te^{-iwt}dt-2A\int_{-2}^{-3/2}e^{-iwt}dt+A\int_{-3/2}^{0}te^{-iwt}dt$$

$$+A\int_{-3/2}^{0}e^{-iwt}dt-A\int_{0}^{3/2}te^{-iwt}dt+A\int_{0}^{3/2}e^{-iwt}dt+$$

$$A\int_{3/2}^{2}te^{-iwt}dt-2A\int_{3/2}^{2}e^{-iwt}dt$$

$u=t \quad du=dt$

$dv=e^{-iwt}dt \quad v=\frac{-1}{iw}e^{-iwt}$

$$=-A\left[\frac{-t}{iw}e^{-iwt}\Big|_{-2}^{-3/2}+\frac{1}{iw}\cdot\left(\frac{-1}{iw}e^{-iwt}\Big|_{-2}^{-3/2}\right)\right]$$

$$-2A\left(\frac{-1}{iw}e^{-iwt}\Big|_{-2}^{-3/2}\right)+A\left[\frac{-t}{iw}e^{-iwt}\Big|_{-3/2}^{0}+\right.$$

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$$\frac{1}{iw}\left(\frac{-1}{iw}e^{-iwt}\Big|_{-3/2}^{0}\right)\Big] + A\left(\frac{-1}{iw}e^{-iwt}\Big|_{-3/2}^{0}\right) - A\Big[\frac{-t}{iw}e^{-iwt}\Big|_{0}^{3/2}$$

$$+\frac{1}{iw}\left(\frac{-1}{iw}e^{-iwt}\Big|_{0}^{3/2}\right)\Big] + A\left(\frac{-1}{iw}e^{-iwt}\Big|_{0}^{3/2}\right) + A\Big[\frac{-t}{iw}e^{-iwt}\Big|_{3/2}^{2}$$

$$+\frac{1}{iw}\left(\frac{-1}{iw}e^{-iwt}\Big|_{3/2}^{2}\right)\Big] - 2A\left(\frac{-1}{iw}e^{-iwt}\Big|_{3/2}^{2}\right)$$

$$= -A\Big[\frac{3}{2iw}e^{\frac{3}{2}wi} - \frac{2}{iw}e^{2wi} + \frac{1}{w^2}\left(e^{\frac{3}{2}wi} - e^{2wi}\right)\Big] + \frac{2A}{iw}\left(e^{\frac{3}{2}wi} - e^{2wi}\right)$$

$$+A\Big[\frac{-3}{2iw}e^{\frac{3}{2}wi} + \frac{1}{w^2}\left(1 - e^{\frac{3}{2}wi}\right)\Big] - \frac{A}{iw}\left(1 - e^{\frac{3}{2}wi}\right) - A\Big[\frac{-3}{2iw}e^{-\frac{3}{2}iw}$$

$$+\frac{1}{w^2}\left(e^{-\frac{3}{2}wi} - 1\right)\Big] - \frac{A}{iw}\left(e^{-\frac{3}{2}wi} - 1\right) + A\Big[\frac{3}{2iw}e^{-\frac{3}{2}wi} - \frac{2}{iw}e^{-2wi}$$

$$+\frac{1}{w^2}\left(e^{-2wi} - e^{-\frac{3}{2}wi}\right)\Big] + \frac{2A}{iw}\left(e^{-2wi} - e^{-\frac{3}{2}wi}\right)$$

b)

$$f(t) = \begin{cases} At + A & -1 \le t < 0 \\ -\frac{A}{4}t + A & 0 \le t \le 4 \end{cases}$$

$$\mathcal{F}\left[f(t)\right] = \int_{-1}^{0}(At+A)e^{-iwt}\,dt + \int_{0}^{4}\left(-\frac{A}{4}t + A\right)e^{-iwt}\,dt$$

$$= A\int_{-1}^{0} t\,e^{-iwt}\,dt + A\int_{-1}^{0} e^{-iwt}\,dt - \frac{A}{4}\int_{0}^{4} t\,e^{-iwt}\,dt +$$

$$A\int_{0}^{4} e^{-iwt}\,dt = A\Big[\frac{-t}{iw}e^{-iwt}\Big|_{-1}^{0} + \frac{1}{iw}\left(\frac{-1}{iw}e^{-iwt}\Big|_{-1}^{0}\right)\Big]$$

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$$+A\left(\frac{-1}{iW}e^{-iWt}\Big|_{-1}^{0}\right)-\frac{A}{4}\left[\frac{-t}{iW}e^{-iWt}\Big|_{0}^{4}+\frac{1}{iW}\left(\frac{-1}{iW}e^{-iWt}\Big|_{0}^{4}\right)\right]$$

$$+A\left(\frac{-1}{iW}e^{-iWt}\Big|_{0}^{4}\right)=A\left[-\frac{1}{iW}e^{iW}+\frac{1}{W^2}\left(1-e^{iW}\right)\right]+$$

$$-\frac{A}{iW}\left(1-e^{Wi}\right)-\frac{A}{4}\left[\frac{-4}{iW}e^{-4iW}+\frac{1}{W^2}\left(e^{-4iW}-1\right)\right]-\frac{A}{iW}\left(e^{-4iW}-1\right)$$

c) $F(t)=\cos(t)$

$$\mathcal{F}\left[F(t)\right]=\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\cos(t)\,e^{-iWt}\,dt$$

$u=\cos(t)$, $du=-\operatorname{Sen}(t)\,dt$

$dv=e^{-iWt}dt$, $v=\frac{-1}{iW}e^{-iWt}$

$$=-\frac{\cos(t)}{iW}e^{-iWt}\Big|_{-\frac{\pi}{2}}^{\frac{\pi}{2}}-\frac{1}{iW}\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\operatorname{Sen}(t)\,e^{-iWt}\,dt$$

$u=\operatorname{Sen}(t)$, $du=\cos(t)\,dt$

$dv=e^{-iWt}dt$, $v=\frac{-1}{iW}e^{-iWt}$

$$=-\frac{1}{iW}\left[-\frac{\operatorname{Sen}(t)}{iW}e^{-iWt}\Big|_{-\frac{\pi}{2}}^{\frac{\pi}{2}}+\frac{1}{iW}\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\cos(t)\,e^{-iWt}\,dt\right]$$

$$=-\frac{\operatorname{Sen}(t)}{W^2}e^{-iWt}\Big|_{-\frac{\pi}{2}}^{\frac{\pi}{2}}+\frac{1}{W^2}\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}\cos(t)\,e^{-iWt}\,dt$$

$$\mathcal{F}\left[F(t)\right]=\frac{-1}{W^2-1}\left[e^{-\frac{\pi}{2}iW}+e^{\frac{\pi}{2}iW}\right]$$

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d) $$\mathcal{F}[f(t)] = \int_{-2}^{2} \frac{A}{2} t e^{-iwt}\,dt = \frac{A}{2}\int_{-2}^{2} t e^{-iwt}\,dt$$

$$= \frac{A}{2}\left[\frac{-t}{wi} e^{-iwt}\Big|_{-2}^{2} + \frac{1}{wi}\left(\frac{-1}{iw} e^{-iwt}\Big|_{-2}^{2}\right)\right]$$

$$= \frac{A}{2}\left[\frac{-2}{wi} e^{2iw} - \frac{2}{wi} e^{-2iw} + \frac{1}{w^2}\left(e^{-2iw} - e^{2iw}\right)\right]$$

e) $$f(t) = \begin{cases} \frac{A}{2}t & \text{Si } 0 \le t < 2 \\ -\frac{1}{2}At + 2A & \text{Si } 2 \le t < 3 \end{cases}$$

$$\mathcal{F}[f(t)] = \int_{0}^{2} \frac{A}{2} t e^{-iwt}\,dt + \int_{2}^{3} \left(-\frac{1}{2}At + 2A\right) e^{-iwt}\,dt$$

$$= \frac{A}{2}\left[\frac{-t}{wi} e^{-iwt}\Big|_{0}^{2} + \frac{1}{wi}\left(\frac{-1}{iw} e^{-iwt}\Big|_{0}^{2}\right)\right] - \frac{1}{2}A\left[\frac{-t}{wi} e^{-iwt}\Big|_{2}^{3}\right.$$

$$\left. + \frac{1}{wi}\left(\frac{-1}{iw} e^{-iwt}\Big|_{2}^{3}\right)\right] + 2A\left(\frac{-1}{iw} e^{-iwt}\Big|_{2}^{3}\right)$$

$$= \frac{A}{2}\left[\frac{-2}{wi} e^{-2iw} + \frac{1}{w^2}\left(e^{-2iw} - 1\right)\right] - \frac{1}{2}A\left[\frac{2}{wi} e^{-2iw} - \frac{3}{wi} e^{-3iw}\right.$$

$$\left. + \frac{1}{w^2}\left(e^{-3iw} - e^{-2iw}\right)\right] - \frac{2A}{iw}\left(e^{-3iw} - e^{-2iw}\right)$$

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f) $f(t) = t^2$

$$\mathcal{F}[f(t)] = \int_0^1 t^2 e^{-iwt}\,dt$$

$u = t^2 \quad du = 2t\,dt$

$dv = e^{-iwt}\,dt \quad v = -\frac{1}{iw} e^{-iwt}$

$$= -\frac{t^2}{iw} e^{-iwt}\Big|_0^1 + \frac{2}{iw}\int_0^1 t e^{-iwt}\,dt$$

$u = t \quad du = dt$

$dv = e^{-iwt}\,dt \quad v = -\frac{1}{iw} e^{-iwt}$

$$= -\frac{1}{iw} e^{-iw} + \frac{2}{iw}\left[-\frac{t}{iw} e^{-iwt}\Big|_0^1 + \frac{1}{iw}\left(\frac{-1}{iw} e^{-iwt}\Big|_0^1\right)\right]$$

$$= -\frac{1}{iw} e^{-iw} + \frac{2}{iw}\left[-\frac{1}{iw} e^{-iwt} + \frac{1}{w^2}\left(e^{-iw} - 1\right)\right]$$

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