Bennet Sloan Engr 203 6/10/19

9.1 Find the fourier Transform of $\delta(t+3) - \delta(t-3)$

$$\mathcal{F}\{\delta(t+3) - \delta(t-3)\} = \mathcal{F}\{\delta(t+3)\} - \mathcal{F}\{\delta(t-3)\}$$

$$= e^{j\omega 3} - e^{-j\omega 3} \quad \left(\text{using } \mathcal{F}\{\delta(t-t_0)\} = e^{-j\omega t_0}\right)$$

$$= j2\left(\frac{e^{j\omega 3} - e^{-j\omega 3}}{j2}\right) = \boxed{j2\sin(3\omega)}$$

9.2 Find the fourier transform of $\cos(2t)\,u(t)$.

$$\cos(2t)\,u(t) \rightarrow \left(\frac{e^{j2t} + e^{-j2t}}{2}\right) u(t)$$

so $$\mathcal{F}\{\cos(2t)\,u(t)\}(\omega) = \frac{\hat{u}(\omega-a) + \hat{u}(\omega+a)}{2}$$

where $$\hat{u}(\omega) = \frac{1}{j\omega} + \pi\delta(\omega)$$

so, $$\mathcal{F}\{\cos(2t)\,u(t)\} = \boxed{\frac{1}{2}\left[\frac{1}{j(\omega+2)} + \pi\delta(\omega+2) + \frac{1}{j(\omega-2)} + \pi\delta(\omega-2)\right]}$$

9.3 Find the inverse fourier transform of $\frac{5}{jw-2}$.

$$F^{-1}\left\{\frac{5}{jw-2}\right\} = 5F^{-1}\left\{\frac{1}{jw-2}\right\} = \boxed{5e^{-2t}u(t)}$$

(since $F^{-1}\left(\frac{1}{jw-a}\right) = e^{-at}u(t)$)

9.4 Find the inverse fourier transform of $\frac{e^{-j2w}}{1+jw}$,

$$F^{-1}\left\{\frac{e^{-j2w}}{1+jw}\right\} = F^{-1}\left\{e^{-j2w} \cdot \frac{1}{1+jw}\right\}$$

Time shift $\rightarrow$ $F^{-1}\left\{e^{-j2w}\frac{1}{1+jw}\right\} = f(t-2)$

where $f(t) = F^{-1}\left\{\frac{1}{1+jw}\right\} = e^{-t}u(t)$

so, $F^{-1}\left\{\frac{e^{-j2w}}{1+jw}\right\} = \underline{\boxed{e^{-(t-2)}u(t-2)}}$