

5.44 |  $A=1$   $T=2$

$$x(t) = \text{tri}\left(\frac{t}{2}\right) - \frac{1}{2} \text{rect}\left(\frac{t}{1}\right)$$

$$F\left\{\text{tri}\left(\frac{t}{2}\right)\right\} = \tau \cdot \text{sinc}\left(\frac{\omega\tau}{4}\right)$$

$$F\left\{\text{rect}\left(\frac{t}{2}\right)\right\} = \tau \cdot \text{sinc}\left(\frac{\omega\tau}{2}\right)$$

$$X(\omega) = 2 \cdot \text{sinc}\left(\frac{\omega}{2}\right) - 1 \text{sinc}^2\left(\frac{\omega}{2}\right)$$

5.48 |

a.)  $f(t) = A \cos(\omega_0 t - \phi_0)$   
 $= 2 \cos(5t - \pi/5)$

$A=2$   
 $\omega_0 = 5 \text{ rad/s}$   
 $\phi_0 = \pi/5$   
 $\alpha = 0.5$

\* Constant property  $= 2 X(\omega)$

\* Scaling property  $= \frac{1}{5} X\left(\frac{\omega}{5}\right)$

\* Time-shift  $= X(\omega) - e^{-j\omega t_0}$

$$F\{f(t)\} = \frac{2}{5} X\left(\frac{\omega}{5}\right) - e^{-j\omega \pi/5}$$

b.)  $g(t) = e^{-\alpha t} \cos(\omega_0 t) u(t) = e^{-0.5t} \cos(5t) u(t)$

\* frequency shift

\* Modulation  $= e^{-\alpha t} \frac{1}{2} [X(\omega-5) + X(\omega+5)]$

$$F\{g(t)\} = \left(\frac{1}{2} [X(\omega-5) + X(\omega+5)]\right) - 5$$

5.52 |  $F(\omega) = \frac{A}{B+j\omega}$      $A=5$      $B=2$

a.)  $f(3t-2)$

$F\{f(3t-2)\} = *$  Scaling, Time shift

$$= \frac{1}{3} e^{-j2\omega} \times \left( \frac{\omega}{3} \right) = \frac{1}{3} e^{-j2\omega} \frac{5}{2+j\omega}$$

$$\Rightarrow \frac{1}{3} e^{-j2\omega} \left( \frac{15}{2+j\omega} \right)$$

b.)  $t f(t)$     \*

$F\{t f(t)\} = *$  Scaling

$$= \frac{1}{\omega} \times \left( \frac{\omega}{\omega} \right) \Rightarrow \frac{1}{\omega} \cdot \frac{A\omega}{B+j\omega} = \frac{1}{\omega} \cdot \frac{5\omega}{2+j\omega}$$

c.)  $\frac{df(t)}{dt}$     \* Derivative Property

$$\Rightarrow j\omega X(\omega) \Rightarrow j\omega \cdot \frac{5}{2+j\omega}$$

5.56 |  $\frac{\sin(20\pi t)}{\pi t} \cdot \frac{\sin(10\pi t)}{\pi t}$

