

## SHIFTING PRACTICE

$$1. \quad f(t) = \mathcal{L}^{-1} \left( \frac{s}{s^2+1} e^{-3s} \right) = \cos(t-3) \mathcal{U}(t-3)$$

$\downarrow$   $\uparrow$

$$F(s) = \frac{s}{s^2+1} \rightarrow f(t) = \cos t$$

$$2. \quad g(t) = \mathcal{L}^{-1} \left( \frac{1}{(s+2)^2} e^{-4s} \right) = (t-4) e^{-2(t-4)} \mathcal{U}(t-4)$$

$\downarrow$

$$\frac{1}{s^2} \rightarrow t$$
$$\frac{1}{(s+2)^2} \rightarrow t e^{-2t}$$

$$3. \quad g(t) = \mathcal{L}^{-1} \left( \frac{s+4}{(s+4)^2+9} e^{-7s} \right) = e^{-4(t-7)} \cos 3(t-7) \mathcal{U}(t-7)$$

$\downarrow$

$$\frac{s}{s^2+9} \rightarrow \cos 3t$$
$$\frac{s+4}{(s+4)^2+9} \rightarrow e^{-4t} \cos 3t$$

SHIFTING PRACTICE

$$1. \quad \frac{1}{s^2 + 2s + 2} = \frac{1}{(s+1)^2 + 1} \quad \left( \frac{1}{s^2 + 2s + 2} \right) \xrightarrow{\text{partial fraction}} \frac{1}{s+1} - \frac{1}{s+1-j} + \frac{1}{s+1+j}$$

$\downarrow$   
 $\frac{1}{s+1} = \cos t$

$$2. \quad \frac{1}{s^2 + 4s + 5} = \frac{1}{(s+2)^2 + 1} \quad \left( \frac{1}{s^2 + 4s + 5} \right) \xrightarrow{\text{partial fraction}} \frac{1}{s+2} - \frac{1}{s+2-j} + \frac{1}{s+2+j}$$

$\downarrow$   
 $\frac{1}{s+2} = e^{-2t} \cos t$

$$3. \quad \frac{1}{s^2 + 2s + 2} = \frac{1}{(s+1)^2 + 1} \quad \left( \frac{1}{s^2 + 2s + 2} \right) \xrightarrow{\text{partial fraction}} \frac{1}{s+1} - \frac{1}{s+1-j} + \frac{1}{s+1+j}$$

$\downarrow$   
 $\frac{1}{s+1} = \cos t$