For 5.20

(a)

$$\tilde{y}(s)=\frac{1}{s^2-s-2}=\frac{1}{(s-2)(s+1)}=\text{(by partial fractions)} = \frac{\frac{1}{3}}{(s-2)}+\frac{-\frac{1}{3}}{(s+1)}$$

$$L^{-1}\left\{\frac{1}{3}\frac{1}{(s-2)}-\frac{1}{3}\frac{1}{(s+1)}\right\}=\frac{1}{3}L^{-1}\left\{\frac{1}{(s-2)}\right\}-\frac{1}{3}L^{-1}\left\{\frac{1}{(s+1)}\right\}=\text{(Table)}=$$

$$y(t)=\frac{1}{3}e^{2t}-\frac{1}{3}e^{-t}$$

(b)

$$\tilde{y}(s)=\frac{1}{(s+1)(s^2+4)}=$$

By partial fractions) $\frac{1}{(s+1)(s^2+4)}=\frac{A}{s+1}+\frac{Bs+C}{s^2+4}$, $A=-\frac{2}{5}$, B=-A, C=-4A

$$\rightarrow \tilde{y}(s)-\frac{2}{5}L^{-1}\left\{\frac{1}{s+1}\right\}+L^{-1}\left\{\frac{\frac{2}{5}s+\frac{8}{5}}{s^2+4}\right\}=-\frac{2}{5}L^{-1}\left\{\frac{1}{s+1}\right\}+\frac{2}{5}L^{-1}\left\{\frac{s}{s^2+4}\right\}+\frac{8}{5}L^{-1}\left\{\frac{1}{s^2+4}\right\}=$$

$$\text{(Table)}\rightarrow y(t)=-\frac{2}{5}e^{-t}+\frac{2}{5}\cos 2t+\frac{8}{5}\left(\frac{1}{2}\sin 2t\right)=-\frac{2}{5}e^{-t}+\frac{2}{5}\cos 2t+\frac{4}{5}\sin 2t$$

(c) See separate doc and/or pdf on 5.20(c)