A - 13h

I_1

1) h)

$$\frac{s+2}{s(s+4)+7}e^{-2(s+1)} = \frac{s+2}{s^2+4s+7}e^{-2(s+1)} =$$

$$= \frac{s+2}{(s+2)^2+(\sqrt{3})^2}e^{-2(s+2)}\cdot e^2 \circ\!\!-\!\!\bigcirc$$

$$\boxed{\frac{s}{s^2+(\sqrt{3})^2}e^{-2s} \circ\!\!-\!\!\bigcirc \cos(\sqrt{3}(t-2))\,u(t-2)}$$

$$\circ\!\!-\!\!\bigcirc \boxed{e^{-2t+2}\cos(\sqrt{3}(t-2))\,u(t-2)}$$

2) l) $I = \int_0^\infty \frac{\sin t}{t}\,dt$, $F(s) = \int_0^\infty e^{-st} f(t)\,dt$

$f(t) = \frac{\sin t}{t}$, $I = F(0)$, $g(t) = \sin t$

$$f(t) = \frac{\sin t}{t} = \frac{g(t)}{t} \bigcirc\!\!-\!\!\circ \int_s^\infty G(s)\,ds = \int_s^\infty \frac{1}{s^2+1}\,ds =$$

$$= \operatorname{arctg} s \Big|_s^\infty = \frac{\pi}{2} - \operatorname{arctg} s = F(s)$$

$$I = F(0) = \frac{\pi}{2} - \operatorname{arctg} 0 = \boxed{\frac{\pi}{2}}$$

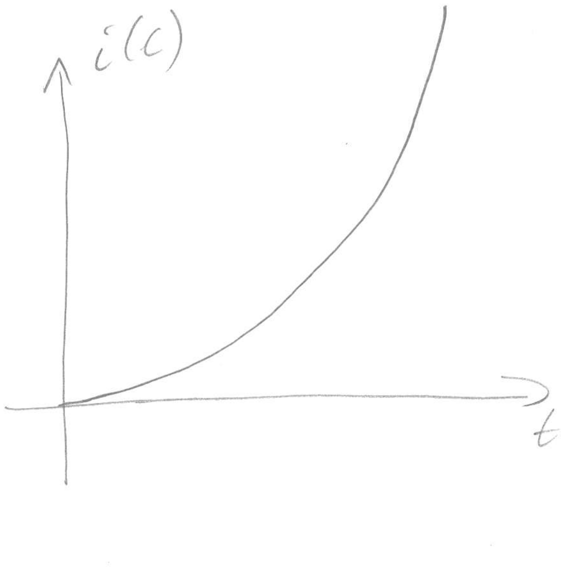
II_1

3) $$e(t)=\int_0^t e^{3\tau} e^{-(t-\tau)}\,d\tau = e^{3t} * e^{-t} \circ\!-\!\bullet \frac{1}{s-3}\cdot\frac{1}{s+1} = E(s)$$

$$Z(s)=\frac{1}{\frac{1}{R_1}+\frac{1}{\frac{1}{Cs}}} + R_2 = \frac{1}{\frac{1}{2}+\frac{1}{2}s}+1 = \frac{2}{s+1}+1 = \frac{s+3}{s+1}$$

$$I(s)=\frac{E(s)}{Z(s)} = \frac{\frac{1}{s-3}\cdot\frac{1}{\cancel{s+1}}}{\frac{s+3}{\cancel{s+1}}} = \frac{1}{s^2-3^2} = \frac{1}{3}\cdot\frac{3}{s^2-3^2} \bullet\!-\!\circ$$

$$\bullet\!-\!\circ \boxed{\frac{1}{3}\,sh(3t)\,u(t) = i(t)}$$



$\boxed{B-13h}$

1) h)

$$\frac{\sqrt{2}}{s^2-6s+11}e^{-s} = \frac{\sqrt{2}}{(s-3)^2+(\sqrt{2})^2}e^{-(s-3)}\cdot e^{-3} \circ\!\!-\!\!\circ$$

$$\boxed{\frac{\sqrt{2}}{s^2+(\sqrt{2})^2}e^{-s} \circ\!\!-\!\!\circ \sin(\sqrt{2}(t-1))\,u(t-1)}$$

$$\circ\!\!-\!\!\circ \boxed{e^{3t-3}\cdot \sin(\sqrt{2}(t-1))\,u(t-1)}$$

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2) h)

$$\int_0^t sh(2t)e^{-3t} \circ\!\!-\!\!\circ \frac{\frac{2}{(s+3)^2-4}}{s} = \boxed{\frac{2}{s(s^2+6s+5)}}$$

$$\boxed{\begin{array}{l} sh(2t)e^{-3t} \circ\!\!-\!\!\circ \dfrac{2}{(s+3)^2-4} \\ sh(2t) \circ\!\!-\!\!\circ \dfrac{2}{s^2-4} \end{array}}$$

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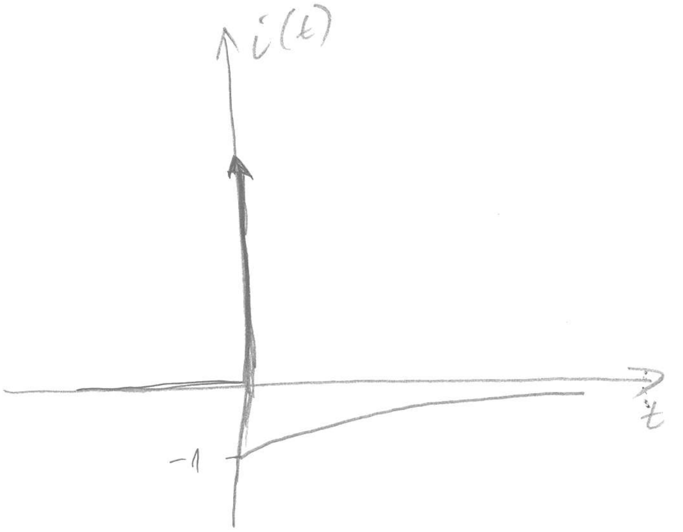
3) $e(t) = 2e^{-2t}u(t) \circ\!\!-\!\!\circ \frac{2}{s+2} = E(s)$

$$Z(s) = \frac{1}{\frac{1}{\frac{1}{C_1 s}} + \frac{1}{R}} + \frac{1}{C_2 s} = \frac{1}{s+2} + \frac{1}{s} =$$

$$= \frac{s+s+2}{s(s+2)} = \frac{2s+2}{s(s+2)}$$

$$I(s) = \frac{E(s)}{Z(s)} = \frac{\frac{2}{\cancel{s+2}}}{\frac{2s+2}{s(\cancel{s+2})}} = \frac{2s}{2s+2} = \frac{s}{s+1} =$$

$$= \frac{s+1}{s+1} - \frac{1}{s+1} = 1 - \frac{1}{s+1} \circ\!\!-\!\!\circ \boxed{\delta(t) - e^{-t}u(t) = i(t)}$$



A-12a

I_3

1) b) $\frac{2}{s^2-2s+5} e^{-2s-1} = \frac{2}{(s-1)^2+2^2} e^{-2(s-1)} \cdot e^{-3} \circ\!-\!\bullet$

$$\boxed{\frac{2}{s^2+2^2} e^{-2s} \circ\!-\!\bullet \sin(2(t-2))\, u(t-2)}$$

$$\circ\!-\!\bullet\ \boxed{e^{t-3} \cdot \sin(2(t-2))\, u(t-2)}$$

2) e) $f(t) \circ\!-\!\bullet F(s)$ $\qquad f(t) = \cos(2t)e^{-t}$

$t f(t) \circ\!-\!\bullet -F'(s)$

$$\cos(2t)e^{-t} \circ\!-\!\bullet \frac{s+1}{(s+1)^2+4} = \frac{s+1}{s^2+2s+5} = F(s)$$

$$t\cos(2t)e^{-t} \circ\!-\!\bullet -\left(\frac{s+1}{s^2+2s+5}\right)' =$$

$$= -\frac{s^2+2s+5-(s+1)(2s+2)}{(s^2+2s+5)^2} =$$

$$= -\frac{s^2+\cancel{2s}+5-2s^2-\cancel{2s}-2s-2}{(s^2+2s+5)^2} =$$

$$= -\frac{-s^2-2s+3}{(s^2+2s+5)^2} = \boxed{\frac{s^2+2s-3}{(s^2+2s+5)^2}}$$

3) $e(t) = \frac{1}{2} e^{-t} u(t) \circ\!\!-\!\!\circ \frac{1}{2} \cdot \frac{1}{s+1} = E(s)$ II_3

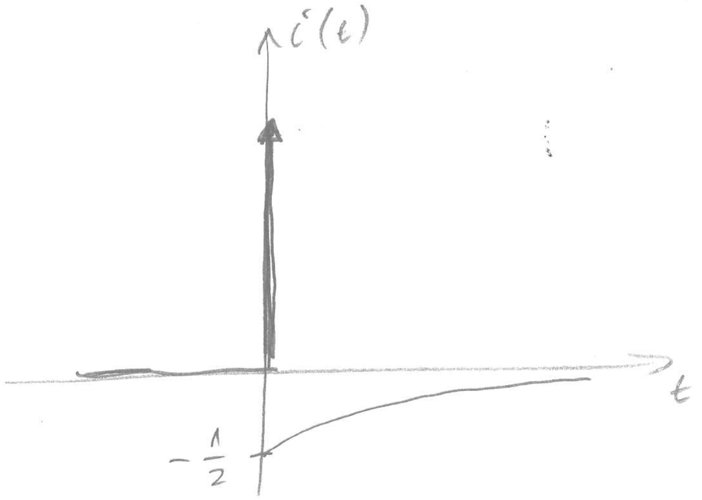
$$Z(s) = \frac{1}{\frac{1}{\frac{1}{Cs}} + \frac{1}{Ls+R}} = \frac{1}{s + \frac{1}{s+2}} =$$

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

$$I(s) = \frac{E(s)}{Z(s)} = \frac{\frac{1}{2} \cdot \frac{1}{\cancel{s+1}}}{\frac{s+2}{(s+1)^{\cancel{2}}}} = \frac{1}{2} \frac{s+1}{s+2} =$$

$$= \frac{1}{2}\left[\frac{s+2}{s+2} - \frac{1}{s+2}\right] = \frac{1}{2} - \frac{1}{2}\frac{1}{s+2} \circ\!\!-\!\!\circ$$

$$\circ\!\!-\!\!\circ \boxed{\frac{1}{2}\delta(t) - \frac{1}{2} e^{-2t} u(t) = i(t)}$$



$\boxed{B-12h}$ I_4

1) b)

$$\frac{s+2}{s^2+4s+9}\,e^{-3s-4} = \frac{s+2}{(s+2)^2+(\sqrt{5})^2}\,e^{-3(s+2)}\,e^{2}$$

$$\frac{s}{s^2+(\sqrt{5})^2}\,e^{-3s} \circ\!\!-\!\!\bullet \cos(\sqrt{5}(t-3))\,u(t-3)$$

$$\circ\!\!-\!\!\bullet \boxed{e^{-2t+2}\cdot\cos(\sqrt{5}(t-3))\,u(t-3)}$$

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2) b) $g(t)=\sin(\sqrt{2}t)\,e^{3t} \circ\!\!-\!\!\bullet \dfrac{\sqrt{2}}{(s-3)^2+2} = G(s)$

$$f(t)=g''(t) \circ\!\!-\!\!\bullet s^2G(s)-s\,g(0)-g'(0) =$$

$$g'(t)=\cos(\sqrt{2}t)\sqrt{2}\,e^{3t}+\sin(\sqrt{2}t)\,e^{3t}\cdot 3$$

$$g'(0)=\sqrt{2}\;,\quad g(0)=0$$

$$=\frac{s^2\sqrt{2}}{(s-3)^2+2}-\sqrt{2} = \boxed{\sqrt{2}\left(\frac{s^2}{(s-3)^2+2}-1\right)}$$

3) $$e(t) = e^{-t}u(t) = \frac{1}{s+1} = E(s)$$

$$Z(s) = \frac{1}{\frac{1}{R} + \frac{1}{Ls + \frac{1}{Cs}}} = \frac{1}{\frac{1}{2} + \frac{1}{s + \frac{1}{s}}} =$$

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

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

$$I(s) = \frac{E(s)}{Z(s)} = \frac{\frac{1}{\cancel{s+1}}}{\frac{2(s^2+1)}{(s+1)^{\cancel{2}}}} = \frac{1}{2}\,\frac{s+1}{s^2+1} =$$

$$= \frac{1}{2}\left(\frac{s}{s^2+1} + \frac{1}{s^2+1}\right) \circ\!\!-\!\!\bullet\; \boxed{\frac{1}{2}(\cos t + \sin t) = i(t)}$$

$$= \frac{1}{2}\left(\sin\left(t + \frac{\pi}{2}\right) + \sin t\right) =$$

$$= \sin\left(\frac{2t + \frac{\pi}{2}}{2}\right)\cos\left(\frac{\frac{\pi}{2}}{2}\right) =$$

$$= \sin\left(t + \frac{\pi}{4}\right)\cos\left(\frac{\pi}{4}\right) =$$

$$= \frac{\sqrt{2}}{2}\sin\left(t + \frac{\pi}{4}\right)$$