$$\mathcal{L}\left\{ t^2 \int_0^t \operatorname{sen}(3u)\,du \right\}$$

$$\frac{d^2}{ds^2} \mathcal{L}\left\{ \int_0^t \operatorname{sen}(3u)\,du \right\}$$

$$f(t) = \operatorname{sen}(3t) \qquad g(t) = 1$$

$$\frac{d^2}{ds^2} \left(\mathcal{L}\{\operatorname{sen}(3t)\} \cdot \mathcal{L}\{1\} \right)$$

$$\frac{d^2}{ds^2} \left(\frac{3}{s^2 + 3^2} \cdot \frac{1}{s} \right)$$

$$\frac{d^2}{ds^2} \left(\frac{3}{s(s^2+9)} \right)$$

$$= \frac{d}{ds} \left(\frac{(\cancel{3})'^{\,0} \cdot (s^3+9s) - 3 \cdot (s^3+9s)'}{[s(s^2+9)]^2} \right) = \frac{d}{ds} \left(\frac{-3(3s^2+9)}{s^2(s^2+9)^2} \right)$$

$$= \frac{d}{ds} \left(\frac{-9s^2 - 27}{s^2(s^2+9)^2} \right) = \frac{[-9s^2-27]' \cdot [s^2(s^2+9)^2] - [-9s^2-27] \cdot [s^2(s^2+9)^2]'}{[s^2(s^2+9)^2]^2}$$

$$= \frac{[-18s][s^2(s^2+9)^2] - (-9s^2-27)(2s(s^2+9)^2 + 2s^2(s^2+9) \cdot [s^2+9]')}{s^4(s^2+9)^4}$$

$$= \frac{-18s^3(s^2+9)^2 - (-9s^2-27)(2s(s^2+9)^2 + 4s^3(s^2+9))}{s^4(s^2+9)^4}$$

$$= \frac{2(-9s^2-27)}{s^3(s^2+9)^2} - \frac{18}{s(s^2+9)^2} - \frac{4(-9s^2-27)}{s(s^2+9)^3}$$

$$= \frac{18(2s^4+9s^2+27)}{s^3(s^2+9)^3}$$

$$= \frac{18(2s^4+9s^2+27)}{s^3(s^2+9)^3}$$

$$\boxed{\mathcal{L}\left\{ t^2 \int_0^t \operatorname{sen}(3u)\,du \right\} = \frac{18(2s^4+9s^2+27)}{s^3(s^2+9)^3}}$$

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$$\mathcal{L}^{-1}\left\{ \frac{e^{-3s} \cdot s}{s^2+6s+13} + \ln\left(\frac{s^2+4}{s+1}\right) \right\}$$

$$\mathcal{L}^{-1}\left\{ \frac{e^{-3s} \cdot s}{s^2+6s+13} \right\} + \mathcal{L}^{-1}\left\{ \ln\left(\frac{s^2+4}{s^2+1}\right) \right\}$$

$$\mathcal{L}^{-1}\left\{ \frac{s+3-3}{(s+3)^2+4} \right\} + \frac{1}{t}\mathcal{L}^{-1}\left\{ -\frac{d}{ds}\left(\ln\left(\frac{s^2+4}{s^2+1}\right)\right) \right\}$$

$$\mathcal{L}^{-1}\left\{ \frac{s+3}{(s+3)^2+4} \right\} + \frac{1}{t}\mathcal{L}^{-1}\left\{ -\frac{d}{ds}\left[\ln(s^2+4) - \ln(s^2+1) \right] \right\}$$

$$e^{-3t}\left[\mathcal{L}^{-1}\left\{ \frac{s}{s^2+4} \right\} + \mathcal{L}^{-1}\left\{ \frac{3}{s^2+4} \right\} \right] - \frac{1}{t}\mathcal{L}^{-1}\left\{ \frac{2s}{s^2+4} - \frac{2s}{s^2+1} \right\}$$

$$e^{-3t}\left[\cos(2t) - \frac{3}{2}\operatorname{sen}(2t) \right] - \frac{1}{t}\left[2\cos(2t) - 2\cos(t) \right]$$

$$\boxed{\left[e^{-3(t-3)}\cos(2(t-3)) - e^{-3(t-3)} \cdot \frac{3}{2}\operatorname{sen}(2(t-3)) \right] \mathcal{U}_3(t) - \frac{2}{t}\cos(2t) + \frac{2}{t}\cos(t)}$$

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