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Tuesday, November 3, 2020 10:38 AM

2. Apply the translation Theorem 7.3.2 or 7.3.2-Alt to find $G(s) = \mathcal{L}\{g(t)\}$.

$$\text{(b)}\ g(t) = \begin{cases} 1-(t-1)^2, & 0 \le t < 1 \\ 1, & 1 \le t < 3 \\ (t-4)^2, & 3 \le t < 4 \\ 0, & 4 \le t \end{cases}$$

$$(1-(t-1)^2)(u(t-0) - u(t-1)) + (u(t-1) - u(t-3))$$
$$+ (t-4)^2(u(t-3) - u(t-4)) + 0(t-4)$$

$$-t^2 + 2t(u(t) - u(t-1)) + (u(t-1) - u(t-3))$$
$$+ (t^2 - 8t + 16)(u(t-3) - u(t-4))$$

Use transform table

$$\boxed{L(t) = -e^{-4s}\left(\frac{2}{s^3} + e^{-3s}\left(\frac{2}{s^3}\right)\right) + e^{-s}\left(\frac{2}{s^3}\right) - \frac{2}{s^3} - e^{-3s}\left(\frac{2}{s^2}\right) + \frac{2}{s^2}}$$

3. Find the inverse Laplace transforms.

$$\text{(b)}\ \mathcal{L}^{-1}\left\{\frac{2s-1}{s(s+1)^2}\left(1-e^{-2s}\right)\right\}$$

Factor:

$$\frac{-1 + e^{-2s} + 2s - 2e^{-2s}s}{s^3 + 2s^2 + s} = -\frac{1}{s^3 + 2s^2 + s} + \frac{e^{-2s}}{s^3 + 2s^2 + s} + \frac{2s}{s^3 + 2s^2 + s} - \frac{2e^{-2s}s}{s^3 + 2s^2 + s}$$

$$-3e^{2-t}t(u(t-2)) + 5e^{2-t}(u(t-2)) + u(t-2) + 3e^{-t}t + e^{-t} - 1$$

$$\boxed{e^{-t}(e^2(5-3t) + e^t)u(t-2) + 3te^{-t} + e^{-t} - 1}$$

Michael Submitted number 4