Serial #

- 1 points for not writing your serial number

King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE207: Signals and Systems (122)
Quiz 6: Laplace Transform

Name: Sec.

Find the Laplace transform for the following signal

$$x(t) = \begin{cases} 1 & 0 \le t \le 1 \\ 0 & otherwise \end{cases}$$

$$x(t) = u(t) - u(t-1)$$

$$X(s) = \frac{1}{s} - \frac{e^{-s}}{s} = \frac{1 - e^{-s}}{s}$$

Find the inverse Laplace transform of $\frac{2s^2-8}{(s^2+4)^2}$

$$\frac{2(s^2-4)}{(s^2+4)^2}$$

Last pair in the table scaled by 2

$$2tcos(2t)u(t)$$

Find the Laplace transform of $x(t) = t^2u(t)$

$$\frac{2}{s^3}$$

Find the Laplace transform of $x(t) = e^{-t}t^2u(t)$

$$\mathbf{\frac{2}{(s+1)^3}}$$

Good Luck, **Dr. Ali Muqaibel**

f(t), t ≧ 0	F(s)	ROC
1. $\delta(t)$	1	All s
2. $u(t)$	$\frac{1}{s}$	$\text{Re}(s) > 0$
3. t	$\frac{1}{s^2}$	$\text{Re}(s) > 0$
4. t^n	$\frac{n!}{s^{n+1}}$	$\text{Re}(s) > 0$
5. e^{-at}	$\frac{1}{s+a}$	$\text{Re}(s) > -a$
6. te^{-at}	$\frac{1}{(s+a)^2}$	$\text{Re}(s) > -a$
7. $t^n e^{-at}$	$\frac{n!}{(s+a)^{n+1}}$	$\text{Re}(s) > -a$
8. $\sin bt$	$\frac{b}{s^2+b^2}$	$\text{Re}(s) > 0$
9. $\cos bt$	$\frac{s}{s^2+b^2}$	$\text{Re}(s) > 0$
10. $e^{-at}\sin bt$	$\frac{b}{(s+a)^2+b^2}$	$\text{Re}(s) > -a$
11. $e^{-at}\cos bt$	$\frac{s+a}{(s+a)^2+b^2}$	$\text{Re}(s) > -a$
12. $t\sin bt$	$\frac{2bs}{(s^2+b^2)^2}$	$\text{Re}(s) > 0$
13. $t\cos bt$	$\frac{s^2-b^2}{(s^2+b^2)^2}$	$\text{Re}(s) > 0$

Name	Property
1. Linearity, (7.10)	$\mathcal{L}[a_1f_1(t) + a_2f_2(t)] = a_1F_1(s) + a_2F_2(s)$
2. Derivative, (7.15)	$\mathcal{L}\left[\frac{df(t)}{dt}\right] = sF(s) - f(0^+)$
3. nth-order derivative, (7.29)	$\mathcal{L}\left[\frac{d^nf(t)}{dt^n}\right] = s^nF(s) - s^{n-1}f(0^+) - \cdots - sf^{(n-2)}(0^+) - f^{(n-1)}(0^+)$
4. Integral, (7.31)	$\mathcal{L}\left[\int_0^t f(\tau)d\tau\right] = \frac{F(s)}{s}$
5. Real shifting, (7.22)	$\mathcal{L}[f(t-t_0)u(t-t_0)] = e^{-t_0s}F(s)$
6. Complex shifting, (7.20)	$\mathcal{L}[e^{-at}f(t)] = F(s+a)$
7. Initial value, (7.36)	$\lim_{t\to 0^+} f(t) = \lim_{s\to\infty} sF(s)$
8. Final value, (7.39)	$\lim_{t\to\infty} f(t) = \lim_{s\to 0} s\,F(s)$
9. Multiplication by t, (7.34)	$\mathcal{L}[tf(t)] = -\frac{dF(s)}{ds}$
10. Time transformation, (7.42) ($a > 0$; $b \geqq 0$)	$\mathcal{L}[f(at-b)u(at-b)] = \frac{e^{-sb/a}}{a}F\left(\frac{s}{a}\right)$
11. Convolution	$\mathcal{L}^{-1}[F_1(s)F_2(s)] = \int_0^t f_1(t-\tau)f_2(\tau)\,d\tau = \int_0^t f_1(\tau)f_2(t-\tau)d\tau$
12. Time periodicity $[f(t) = f(t+T)], t \geqq 0$	$\mathcal{L}[f(t)] = \frac{1}{1-e^{-sT}}F_1(s)$, where $F_1(s) = \int_0^T f(t)e^{-st}\,dt$