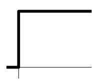
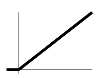
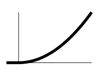
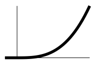
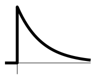
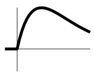
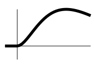
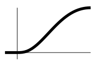
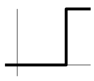
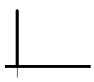
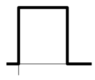
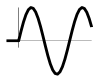
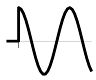
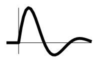
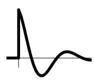
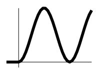
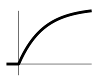
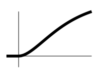
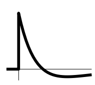
Description	Time domain	Laplace domain
Definition	$f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\} = \int_0^\infty f(t)e^{-st}\,\mathrm{d}t$
Linearity	$g(t) = af(t)$	$G(s) = aF(s)$
	$g(t) = f(t) + h(t)$	$G(s) = F(s) + H(s)$
Differentiation	$g(t) = \frac{\mathrm{d}f(t)}{\mathrm{d}t}$	$G(s) = sF(s) - f(0)$
	$g(t) = \frac{\mathrm{d}^2 f}{\mathrm{d}t^2}(0)$	$G(s) = s^2F(s) - sf(0) - \frac{\mathrm{d}f(t)}{\mathrm{d}t}$
	$g(t) = \frac{\mathrm{d}^n f(t)}{\mathrm{d}t^n}$	$G(s) = s^nF(s) - s^{n-1}f(0) - s^{n-2}\frac{\mathrm{d}f}{\mathrm{d}t}(0) - \ldots$ $\ldots - s^2\frac{\mathrm{d}^{n-3}f}{\mathrm{d}t^{n-2}}(0) - s\frac{\mathrm{d}^{n-2}f}{\mathrm{d}t^{n-2}}(0) - \frac{\mathrm{d}^{n-1}f}{\mathrm{d}t^{n-1}}(0)$
Integration	$g(t) = \int_0^\infty f(t)\,\mathrm{d}t$	$G(s) = \frac{1}{s}F(s)$
	$g(t) = \int_0^\infty \int_0^\infty f(t)\,\mathrm{d}t\,\mathrm{d}t$	$G(s) = \frac{1}{s^2}F(s)$
Unit step	$f(t) = 1$	 $F(s) = \frac{1}{s}$
Unit ramp	$f(t) = t$	 $F(s) = \frac{1}{s^2}$
Unit parabola	$f(t) = t^2$	 $F(s) = \frac{2}{s^3}$

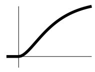
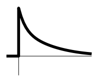
Continued ...

Description	**Time domain**		**Laplace domain**
Definition	$f(t) = \mathcal{L}^{-1}\{F(s)\}$		$F(s) = \mathcal{L}\{f(t)\} = \int_0^\infty f(t)e^{-st}\,\mathrm{d}t$
Powers of t	$f(t) = t^n$		$F(s) = \frac{n!}{s^{(n+1)!}}$
Exponential decay	$f(t) = e^{-at}$		$F(s) = \frac{1}{(s+a)}$
	$f(t) = te^{-at}$		$F(s) = \frac{1}{(s+a)^2}$
	$f(t) = t^2e^{-at}$		$F(s) = \frac{2}{(s+a)^3}$
	$f(t) = t^ne^{-at}$		$F(s) = \frac{n!}{(s+a)^{(n+1)!}}$
Pure delay T	$f(t) = g(t-T)$		$F(s) = e^{-sT}G(s)$
Delayed unit step	$f(t) = \begin{cases} 1 & \text{if } t > T > 0 \\ 0 & \text{otherwise} \end{cases}$		$F(s) = \frac{e^{-sT}}{s}$
Unit impulse	$f(t) = \begin{cases} 1 & \text{if } t = 0 \\ 0 & \text{otherwise} \end{cases}$		$F(s) = 1$

Continued ...

Description	Time domain		Laplace domain
Definition	$f(t) = \mathcal{L}^{-1}\{F(s)\}$		$F(s) = \mathcal{L}\{f(t)\} = \int_0^\infty f(t) e^{-st}\,\mathrm{d}t$
Rectangular pulse	$f(t) = \begin{cases} 1 & \text{if } 0 < t < T \\ 0 & \text{otherwise} \end{cases}$		$F(s) = \dfrac{1 - e^{-sT}}{s}$
Sinusoid	$f(t) = \sin(\omega t)$		$F(s) = \dfrac{\omega}{s^2 + \omega^2}$
	$f(t) = \cos(\omega t)$		$F(s) = \dfrac{s}{s^2 + \omega^2}$
	$f(t) = e^{-at}\sin(\omega t)$		$F(s) = \dfrac{\omega}{(s+a)^2 + \omega^2}$
	$f(t) = e^{-at}\cos(\omega t)$		$F(s) = \dfrac{s+a}{(s+a)^2 + \omega^2}$
	$f(t) = 1 - \cos(\omega t)$		$F(s) = \dfrac{\omega^2}{s(s^2 + \omega^2)}$
Compound signals	$f(t) = 1 - e^{-at}$		$F(s) = \dfrac{1}{s} - \dfrac{1}{s+a} = \dfrac{a}{s(s+a)}$
	$f(t) = \dfrac{1}{a}\left(t - \dfrac{1 - e^{-at}}{a}\right)$		$F(s) = \dfrac{1}{s^2(s+a)}$
	$f(t) = \dfrac{1}{a^2}\left(1 - e^{-at} - ate^{-at}\right)$		$F(s) = \dfrac{1}{s(s+a)^2}$
	$f(t) = (1 - at)\, e^{-at}$		$F(s) = \dfrac{s}{(s+a)^2}$

Continued …

Description	Time domain		Laplace domain
Definition	$f(t) = \mathcal{L}^{-1}\{F(s)\}$		$F(s) = \mathcal{L}\{f(t)\} = \int_0^\infty f(t) e^{-st} \, \mathrm{d}t$
	$f(t) = \dfrac{\left(e^{-at} - e^{-bt}\right)}{b - a}$		$F(s) = \dfrac{1}{(s+a)(s+b)}$
	$f(t) = 1 - \dfrac{b}{b-a} e^{-at} + \dfrac{a}{b-a} e^{-bt}$		$F(s) = \dfrac{ab}{s(s+a)(s+b)}$
	$f(t) = \dfrac{e^{-at}}{(b-a)(c-a)} \cdots$ $\cdots - \dfrac{e^{-bt}}{(c-a)(a-b)} \cdots$ $\cdots + \dfrac{e^{-ct}}{(a-c)(b-c)}$		$F(s) = \dfrac{1}{(s+a)(s+b)(s+c)}$
Second order	$f(t) = \dfrac{\omega}{\sqrt{1-\zeta^2}} e^{-\zeta \omega t} \sin\left(\omega \sqrt{1-\zeta^2} t\right)$		$F(s) = \dfrac{\omega^2}{s^2 + 2\zeta\omega s + \omega^2}$
	$f(t) = 1 + A_1 e^{P_1 t} + A_2 e^{P_2 t}$		$F(s) = \dfrac{\omega^2}{s\left(s^2 + 2\zeta\omega s + \omega^2\right)}$

where $a, T, \omega \in \mathbb{R}$ and $n \in \mathbb{N}$ are constants; $t, \tau \in \mathbb{R} \geq 0$ are time; and $s \in \mathbb{C}$ is the Laplace operator; and

$$A_1 = -\frac{1}{2} - \frac{\zeta}{2\sqrt{\zeta^2 - 1}} \qquad P_1 = -\zeta\omega - \omega\sqrt{\zeta - 1}$$

$$A_2 = -\frac{1}{2} + \frac{\zeta}{2\sqrt{\zeta^2 - 1}} \qquad P_2 = -\zeta\omega + \omega\sqrt{\zeta - 1}$$