TOOL: The following identity generates the basic Laplace transforms:

$$\mathcal{L}\left[\frac{d^\chi}{dt^\chi}\left(t^n e^{-at}(A\cos\omega t + B\sin\omega t)u(t)\right)\right] = s^\chi(-1)^n \frac{d^n}{ds^n}\frac{A(s+a)+B\omega}{(s+a)^2+\omega^2}$$

where $\chi = 0$ or 1; n, a, $\omega \geq 0$; $u(t)$ is the unit step function; and sgn(n) is the signum function as defined below.

$$u(t) \equiv \begin{cases} 0 & t < 0 \\ 1 & t \geq 0 \end{cases} \qquad \operatorname{sgn}(n) \equiv \begin{cases} -1 & t < 0 \\ 0 & t = 0 \\ 1 & t > 0 \end{cases}$$

TABLE:

$v(t)$	$V(s)$	condition
$\delta(t)$	1	χ=**1**, n=0, a=0, ω=0, A=**1**, B=0
1	$\frac{1}{s}$	χ=0, n=0, a=0, ω=0, A=**1**, B=0
t	$\frac{1}{s^2}$	χ=0, n=**1**, a=0, ω=0, A=**1**, B=0
t^n	$\frac{n!}{s^{n+1}}$	χ=0, ***n*≥0**, a=0, ω=0, A=**1**, B=0
e^{-at}	$\frac{1}{s+a}$	χ=0, n=0, ***a*≥0**, ω=0, A=**1**, B=0
te^{-at}	$\frac{1}{(s+a)^2}$	χ=0, n=**1**, ***a*≥0**, ω=0, A=**1**, B=0
$t^n e^{-at}$	$\frac{n!}{(s+a)^{n+1}}$	χ=0, ***n*≥0**, ***a*≥0**, ω=0, A=**1**, B=0
$\cos(\omega t)$	$\frac{s}{s^2+\omega^2}$	χ=0, n=0, a=0, **ω≥0**, A=**1**, B=0
$\sin(\omega t)$	$\frac{\omega}{s^2+\omega^2}$	χ=0, n=0, a=0, **ω≥0**, A=0, B=**1**
$Ae^{-at}\cos(\omega t)$	$A\frac{(s+a)}{(s+a)^2+\omega^2}$	χ=0, n=0, ***a*≥0**, **ω≥0**, ***A*=*A***, B=0
$Be^{-at}\sin(\omega t)$	$B\frac{\omega}{(s+a)^2+\omega^2}$	χ=0, n=0, ***a*≥0**, **ω≥0**, A=0, ***B*=*B***

REF: [1] James A. Nilsson, Susan A. Riedel, *Electric Circuits,* 8th Ed., Upper Saddle River, NJ: Prentice Hall, 2007.