TOOL: The following identities generate basic Laplace transforms:

$$\mathcal{L}\left[t^n e^{-at}\cos(\omega t)u(t)\right] = \frac{n!\mathrm{Re}[(s+a+j\omega)^{n+1}]}{[(s+a)^2+\omega^2]^{n+1}}$$

$$\mathcal{L}\left[t^n e^{-at}\sin(\omega t)u(t)\right] = \frac{n!\mathrm{Im}[(s+a+j\omega)^{n+1}]}{[(s+a)^2+\omega^2]^{n+1}}$$

where n, a, $\omega \geq 0$; $\delta(t)$ is the impulse (or delta) function, and $u(t)$ is the unit step function:

$$\delta(t) \equiv \begin{cases} 0 & t \neq 0 \\ \infty & t = 0 \end{cases} \quad \text{with} \quad \int_{-\infty}^{\infty} \delta(t)\,dt = 1, \qquad u(t) \equiv \begin{cases} 0 & t < 0 \\ 1 & t \geq 0 \end{cases}$$

TABLE:

$v(t)$	$V(s)$	values in basic identity
1 or $u(t)$	$\frac{1}{s}$	$n=0,\ a=0,\ \omega=0$
t	$\frac{1}{s^2}$	$n=1,\ a=0,\ \omega=0$
t^n	$\frac{n!}{s^{n+1}}$	$n\geq 0,\ a=0,\ \omega=0$
e^{-at}	$\frac{1}{s+a}$	$n=0,\ a\geq 0,\ \omega=0$
te^{-at}	$\frac{1}{(s+a)^2}$	$n=1,\ a\geq 0,\ \omega=0$
$t^n e^{-at}$	$\frac{n!}{(s+a)^{n+1}}$	$n\geq 0,\ a\geq 0,\ \omega=0$
$\cos(\omega t)$	$\frac{s}{s^2+\omega^2}$	$n=0,\ a=0,\ \omega\geq 0$
$\sin(\omega t)$	$\frac{\omega}{s^2+\omega^2}$	$n=0,\ a=0,\ \omega\geq 0$
$Ae^{-at}\cos(\omega t)$	$A\frac{(s+a)}{(s+a)^2+\omega^2}$	$n=0,\ a\geq 0,\ \omega\geq 0$
$Be^{-at}\sin(\omega t)$	$B\frac{\omega}{(s+a)^2+\omega^2}$	$n=0,\ a\geq 0,\ \omega\geq 0$

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