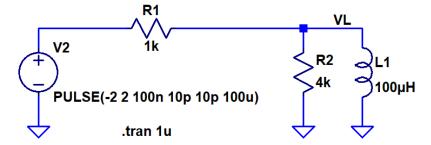
Name:

Closed book and notes.

Show your work for credit and place a box around each of your answers. Note the information on the back of the quiz!

1. Using the Laplace transform determine, and sketch, the voltage across the inductor from 0 to 1 us. (5 points)



## 12-2.1 Definition of the Laplace Transform

The symbol  $\mathcal{L}[f(t)]$  is a short-hand notation for "the Laplace transform of function f(t)." Usually denoted F(s), the Laplace transform is defined by

$$\mathbf{F}(\mathbf{s}) = \mathcal{L}[f(t)] = \int_{0^{-}}^{\infty} f(t) \ e^{-\mathbf{s}t} \ dt,$$
 (12.10)

Table 12-2: Examples of Laplace transform pairs for  $T \ge 0$ . Note that multiplication by u(t) guarantees that f(t) = 0 for  $t < 0^-$ .

Laplace Transform Pairs			
	f(t)		$\mathbf{F}(\mathbf{s}) = \mathbf{\mathcal{L}}[f(t)]$
1	$\delta(t)$	$\leftrightarrow$	1
1a	$\delta(t-T)$	$\leftrightarrow$	$e^{-Ts}$
2	1 or $u(t)$	$\leftrightarrow$	$\frac{1}{s}$
2a	u(t-T)	$\leftrightarrow$	$\frac{e^{-Ts}}{s}$
3	$e^{-at} u(t)$	$\leftrightarrow$	$\frac{1}{s+a}$
3a	$\epsilon^{-a(t-T)}\;u(t-T)$	$\leftrightarrow$	$\frac{e^{-Ts}}{s+a}$
4	t u(t)	$\leftrightarrow$	$\frac{1}{s^2}$
4a	(t-T) u(t-T)	$\leftrightarrow$	$\frac{e^{-Ts}}{s^2}$
5	$t^2 u(t)$	$\leftrightarrow$	$\frac{2}{\mathbf{s}^3}$
6	$te^{-at} u(t)$	$\leftrightarrow$	$\frac{1}{(\mathbf{s}+a)^2}$
7	$t^2e^{-at} u(t)$	$\leftrightarrow$	$\frac{2}{(\mathbf{s}+a)^3}$
8	$t^{n-1}e^{-at}\;u(t)$	$\leftrightarrow$	$\frac{(n-1)!}{(s+a)^n}$
9	$\sin \omega t \ u(t)$	$\leftrightarrow$	$\frac{\omega}{\mathbf{s}^2 + \omega^2}$
10	$\sin(\omega t + \theta) u(t)$	$\leftrightarrow$	$\frac{\mathbf{s}\sin\theta + \omega\cos\theta}{\mathbf{s}^2 + \omega^2}$
11	$\cos \omega t \ u(t)$	$\leftrightarrow$	$\frac{\mathbf{s}}{\mathbf{s}^2 + \omega^2}$
12	$\cos(\omega t + \theta) u(t)$	$\leftrightarrow$	$\frac{\mathbf{s}\cos\theta - \omega\sin\theta}{\mathbf{s}^2 + \omega^2}$
13	$e^{-at}\sin\omega t\ u(t)$	$\leftrightarrow$	$\frac{\omega}{(\mathbf{s}+a)^2+\omega^2}$
14	$e^{-at}\cos\omega t\ u(t)$	$\leftrightarrow$	$\frac{\mathbf{s}+a}{(\mathbf{s}+a)^2+\omega^2}$
15	$2e^{-at}\cos(bt-\theta)u(t)$	$\leftrightarrow$	$\frac{e^{j\theta}}{\mathbf{s}+a+jb} + \frac{e^{-j\theta}}{\mathbf{s}+a-jb}$
16	$\frac{2t^{n-1}}{(n-1)!}e^{-at}\cos(bt-\theta)u(t)$	$\leftrightarrow$	$\frac{e^{j\theta}}{(\mathbf{s}+a+jb)^n} + \frac{e^{-j\theta}}{(\mathbf{s}+a-jb)^n}$
Note: $(n-1)! = (n-1)(n-2)1$ .			