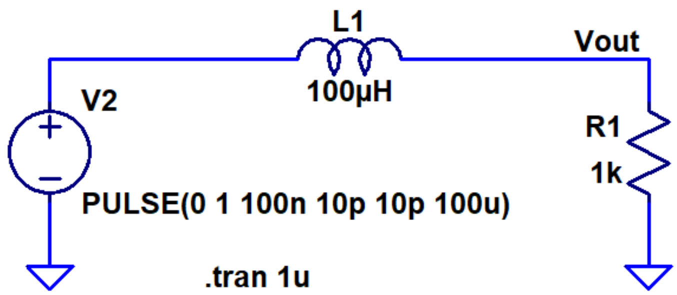
Quiz #19 EE 221 Spring 2021 Name:____________________________________

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 current that flows in the following circuit 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 $\mathbf{F}(s)$, the Laplace transform is defined by

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

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

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

Note: $(n-1)! = (n-1)(n-2)\ldots 1$.