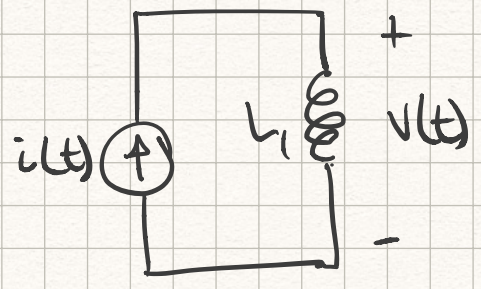
ex:

G: $i = (0.01)\cos(1000t)$



$L_1 = 10\,mH$

F: $v(t)$

S: $v(t) = L\frac{di}{dt}$

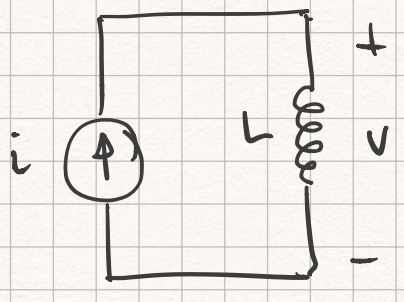
$= L\frac{d}{dt}(.01\cos(1000t))$

$= 10\,mH \cdot 0.01 \cdot -\sin(1000t) \cdot 1000$

$v(t) = -0.1\sin(1000t)\,V$

G:

$$i(t) = \begin{cases} 0, & t < 0 \\ 8e^{-300t} - 8e^{-1200t}, & t \geq 0 \end{cases}$$



$L = 4\,mH$

F: a) Positive t value when $v(t) = 0$

$v(t) = L\frac{di}{dt}$

$v(t) = L(-2400e^{-300t} + 9600e^{-1200t})$

set to 0

$$2400e^{-300t} = 9600e^{-1200t} \qquad \text{let } u = -300$$

$$e^{ut} = 4e^{4ut}$$

$$1 = 4e^{3ut}$$

$$0.25 = e^{3ut}$$

$$\ln(0.25) = 3(-300)t$$

$$\boxed{t = 1.54 \text{ ms}}$$

b) $V(0^+)$

$$V(0^+) = L\frac{di(0^+)}{dt}$$

$$= L\left(-2400e^{-300t} + 9600e^{-1200t}\right)$$

$$\boxed{V(0^+) = 28.8 \text{ V}}$$

c) $P(t)$

$$P(t) = \left(8e^{-300t} - 8e^{-1200t}\right) \cdot L\left(-2400e^{-300t} + 9600e^{-1200t}\right)$$

$$= L\left(-19200e^{-600t} + 76800e^{-1500t} + 19200e^{-1500t} - 76800e^{-2400t}\right)$$

$$= L\left(-19200e^{-600t} + 96000e^{-1500t} - 76800e^{-2400t}\right)$$

$$-76.8e^{-600t} + 384e^{-1500t} - 307.2e^{-2400t}$$

d) Max power → set $\frac{dP}{dt} = 0$

$$\frac{d}{dt}\left[-76.8e^{-600t} + 384e^{-1500t} - 307.2e^{-2400t}\right] = 0$$

$$\frac{e^{+2400t}}{46080}\left(46080e^{-600t} + -576000e^{-1500t} + 737280e^{-2400t}\right) = 0$$

$$\rightarrow \quad e^{1800t} - 12.5e^{900t} + 16 = 0$$

let $x = e^{900t}$

$$\rightarrow \quad x^2 - 12.5x + 16 = 0$$

$$\rightarrow \quad \frac{+12.5 \pm \sqrt{(-12.5)^2 - 4 \cdot 16}}{2} \quad \Big\} \quad \begin{aligned} x_1 &= 11.0523 \\ x_2 &= 1.4467 \end{aligned}$$

$$\rightarrow \quad t_1 = \frac{\ln(x_1)}{900} = 2.670\,ms$$

$$t_2 = \frac{\ln(x_2)}{900} = 411\,\mu s$$

plug into $p(t)$ → $p(t_1) = -9.8\,W$

$p(t_2) = 32.72\,W$

can Δ instant.	v	i
cannot Δ instant	i	v
E stored	$\frac{Li^2}{2}$	$\frac{Cv^2}{2}$
v	$L\frac{di}{dt}$	$\frac{1}{C}\int_0^t i\,d\tau + v(0^+)$
i	$\frac{1}{L}\int_0^t v\,d\tau + i(0^+)$	$C\frac{dv}{dt}$
$P = vi$	$Li\frac{di}{dt}$	$Cv\frac{dv}{dt}$
$f \to 0$ Hz	S.C.	O.C.
$f \to \infty$ Hz	O.C.	S.C.
Units	Farad (F)	Henry (H)