$$g(t) = \int_0^t f(\tau)\,d\tau$$

$$\mathcal{L}[g(t)]$$

To show

$$|g(t)| \leq Me^{kt} \Rightarrow \mathcal{L}[g(t)] \text{ exists.}$$

$$|g(t)| = \left|\int_0^t f(\tau)\,d\tau\right|$$

$$\leq \int_0^t |f(\tau)|\,d\tau$$

$$|f(t)| \leq M_1 e^{k_1 t}$$

$$\leq \int_0^t M_1 e^{k_1 \tau}\,d\tau$$

$$= M_2 e^{k_1 t}$$

$$|g(t)| \leq M_2 e^{k_1 t}$$

$$F(s) = \int_0^\infty e^{-st} f(t)\, dt.$$

Given $\underline{|f(t)| \leq M e^{kt}}$

$$|F(s)| = \left| \int_0^\infty e^{-st} f(t)\, dt \right|$$

$$\leq \int_0^\infty e^{-st} |f(t)|\, dt.$$

$$\leq \int_0^\infty e^{-st} \cdot M e^{kt}\, dt$$

M, k const.

$$= M \int_0^\infty e^{-(s-k)t}\, dt$$

$$\Gamma(\nu) = \int_0^\infty e^{-t} t^{\nu-1} \, dt$$

$$\int u \, dv$$

$$= \int_0^\infty \underbrace{t^{\nu-1}}_{u} \, d\Big(\underbrace{\frac{e^{-t}}{-1}}_{v}\Big)$$

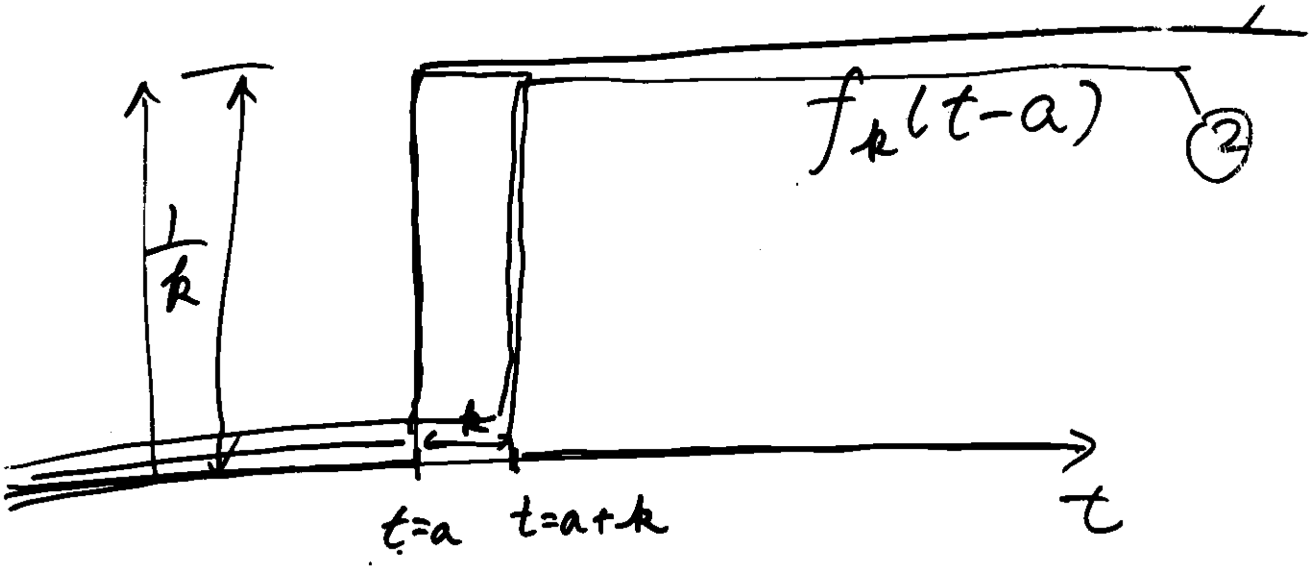
$$= t^{\nu-1} \cdot \frac{e^{-t}}{(-1)} \Bigg]_0^\infty - \int_0^\infty \frac{e^{-t}}{(-1)} \, \underbrace{d\left(t^{\nu-1}\right)}_{(\nu-1)\, t^{\nu-2} \, dt}$$

$$= \underbrace{t^{\nu-1} \frac{e^{-t}}{(-1)} \Bigg]_0^\infty}_{= \phi} + (\nu-1) \underbrace{\int_0^\infty e^{-t} t^{\nu-2} \, dt}_{\Gamma(\nu-1)}$$

$$\Rightarrow \Gamma(\nu) = (\nu-1)\,\Gamma(\nu-1)$$

$$\mathcal{L}[\delta(t)] = 1$$

$$\delta(t-a) = e^{-as}$$



$f_k(t-a)$
$\frac{1}{k}$
k
$t=a$
$t=a+k$
t
2

$$\mathcal{L}\{f'(t)\} = sF(s) - f(0)$$

$$\mathcal{L}\{e^{at}f(t)\} = F(s-a)$$

$$\mathcal{L}\{t^n\} = \frac{n!}{s^{n+1}}$$

$$\mathcal{L}\{t^a\} = \frac{\Gamma(a+1)}{s^{a+1}}$$

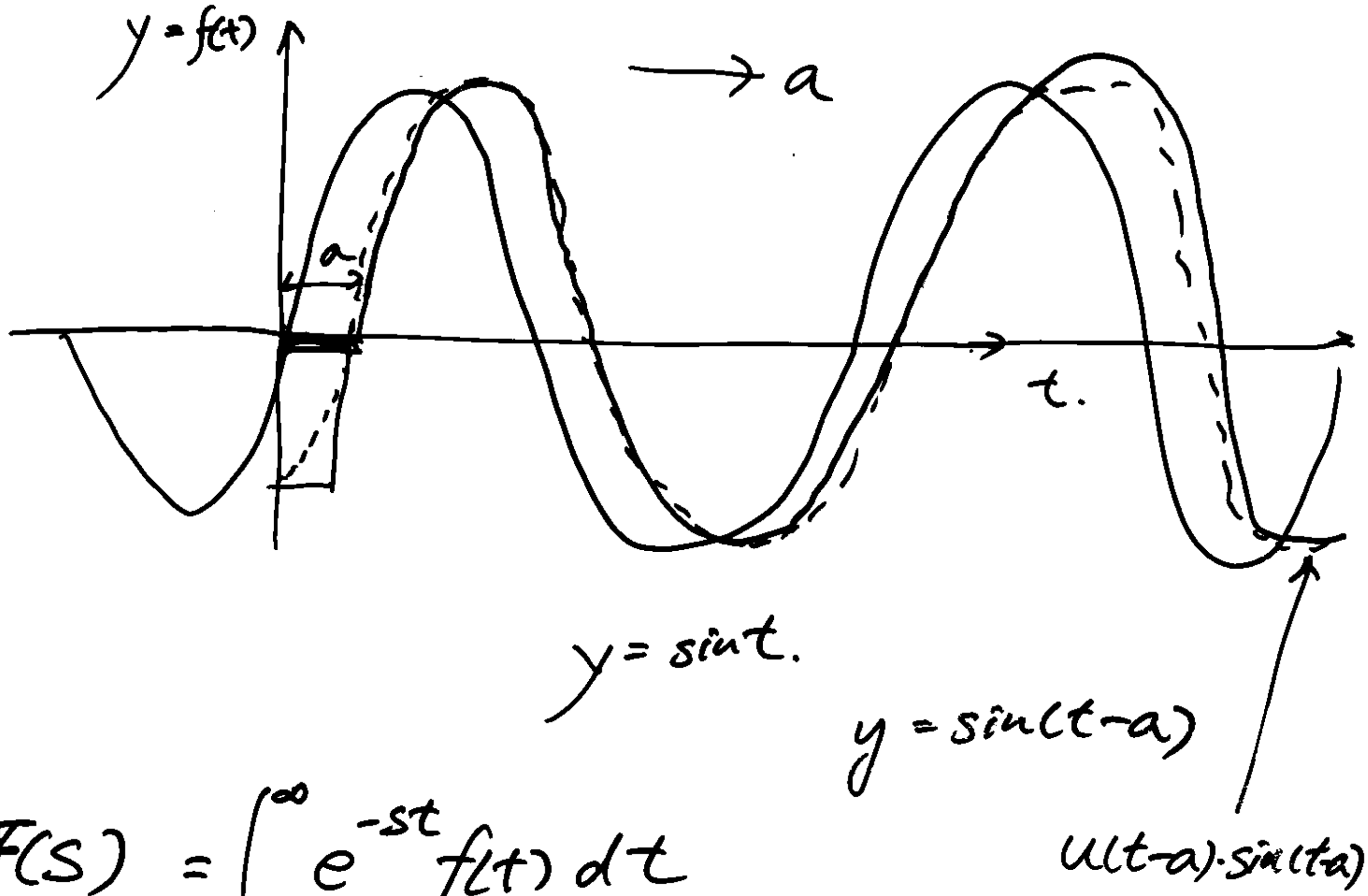
$$\mathcal{L}\left\{\int_0^t f(\tau)\,d\tau\right\} = \frac{1}{s}F(s)$$

$$\mathcal{L}\{u(t-a)\} = \frac{e^{-as}}{s}$$

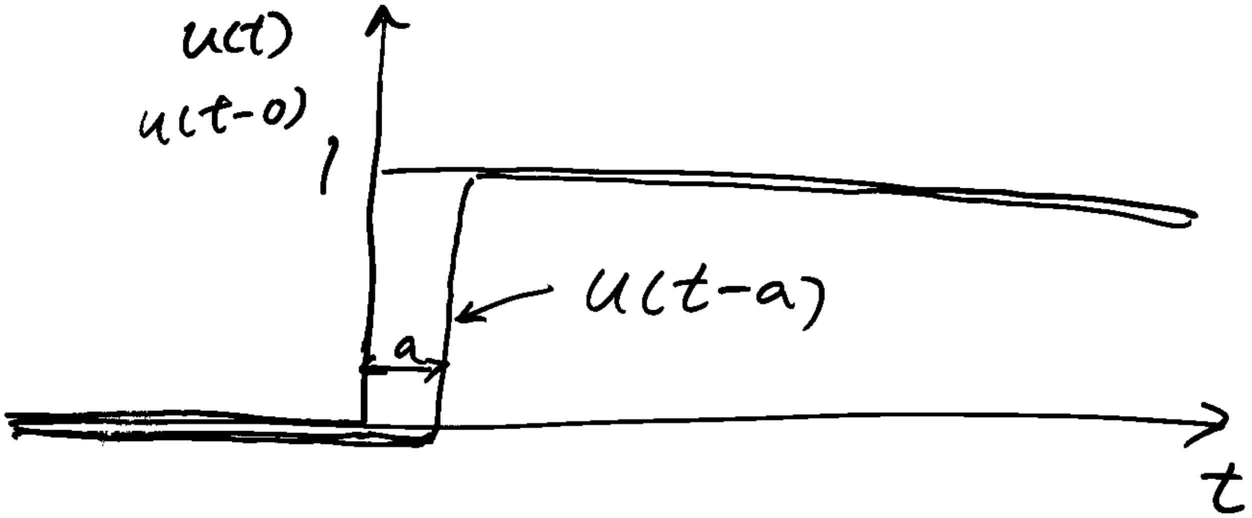
$$\mathcal{L}\{f(t-a)\,u(t-a)\} = e^{-as}F(s)$$

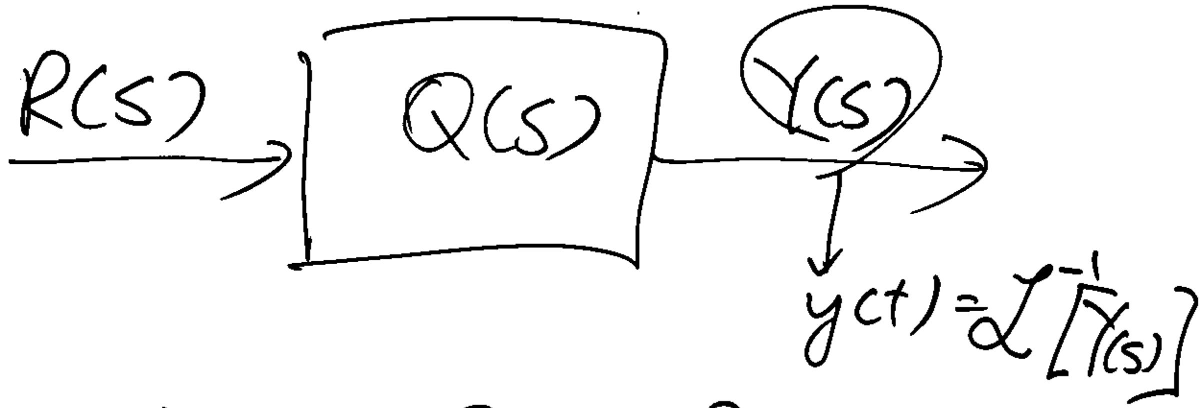
$$\mathcal{L}\{\delta(t-a)\} = e^{-as}$$

$$\mathcal{L}\{t\,f(t)\} = -F'(s)$$



$$F(s) = \int_0^\infty e^{-st} f(t)\, dt$$





$$Y(s) = \underline{Q(s)} \cdot R(s)$$