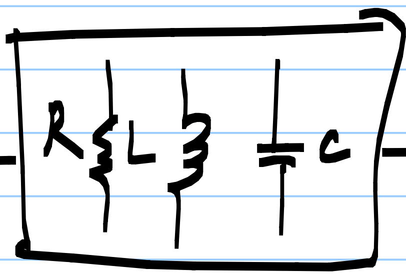
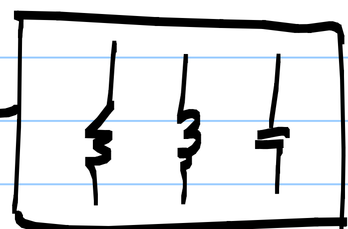
EE2015 — voltage/current — 7/11/2017

$x(t)$ →  → $y(t)$

$\delta(t)$ → $h(t)$

$y(t)$ from $x(t)$ using d.e.

$H(s) \xrightarrow{\text{I.L.T}} h(t)$

$X(s)$ →  → $Y(s)$

$X(s) = 1$

$$Y(s) = X(s) \cdot H(s)$$

Zeros

$$H(s) = \frac{b_M s^M + \dots + b_1 s + b_0}{a_N s^N + \dots + a_1 s + a_0}$$

poles {denominator}

$\exp(st)$

Complex frequency

$s = \quad + \quad$

$\rightarrow$ $\cos(\omega_0 t + \angle H(j\omega_0))$

$\exp(\sigma t)$

$\rightarrow$

$$\frac{1}{j2\pi} \int \frac{s}{s^2 + \omega_0^2} \cdot H(s) \cdot ds$$

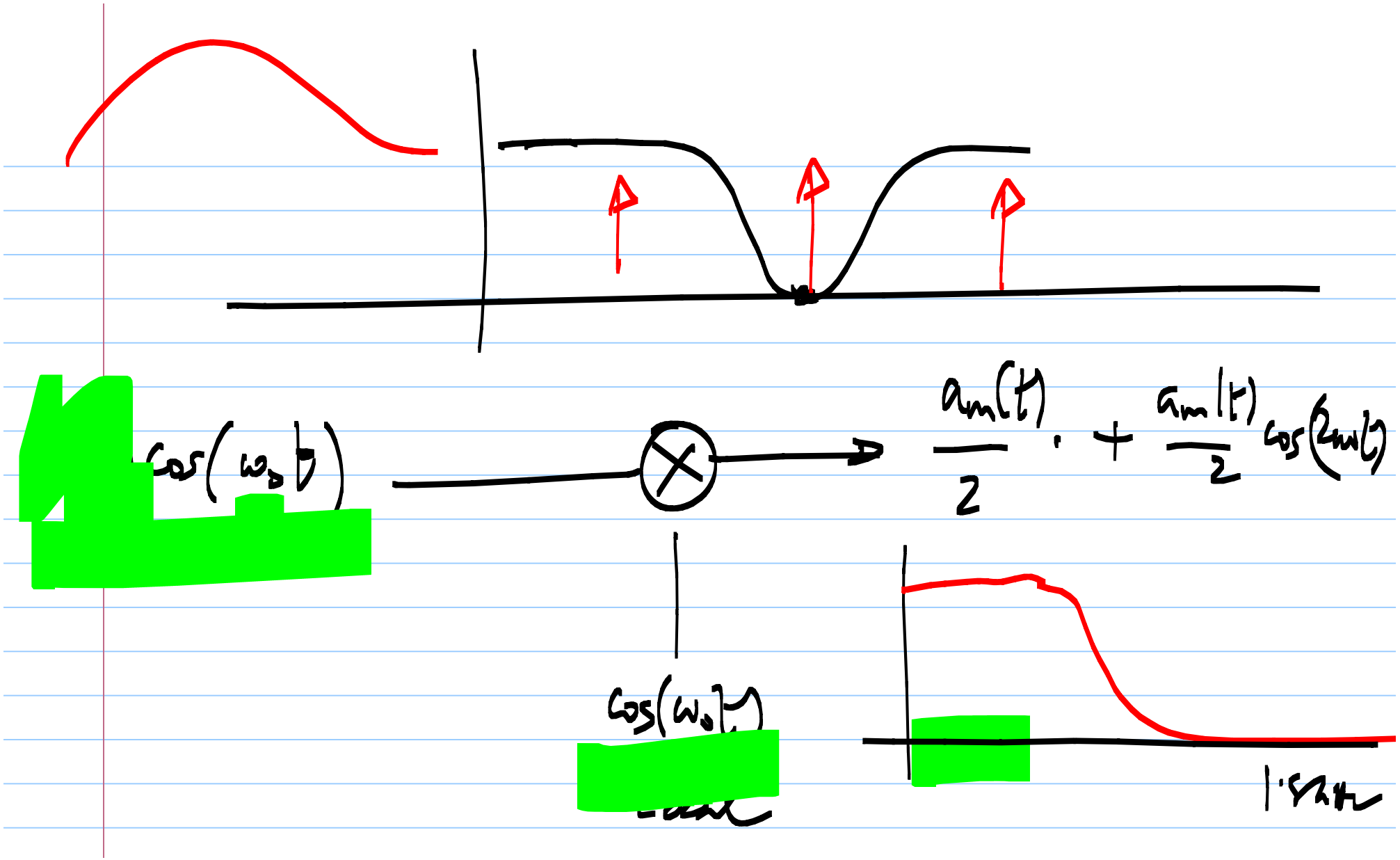
Sinusoidal

To remove a 1 GHz signal

Zeros: $\pm j\, 2\pi G\, \text{rad/s}$

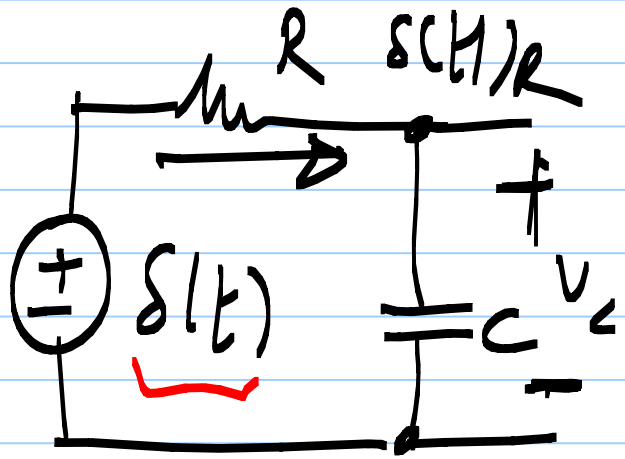
$$H(s) = \frac{s^2 + w_0^2}{D(s)}$$

$$\frac{\frac{s}{s^2 + w_0^2}}{\frac{s}{D(s)}} \cdot \frac{s^2 + w_0^2}{D(s)}$$

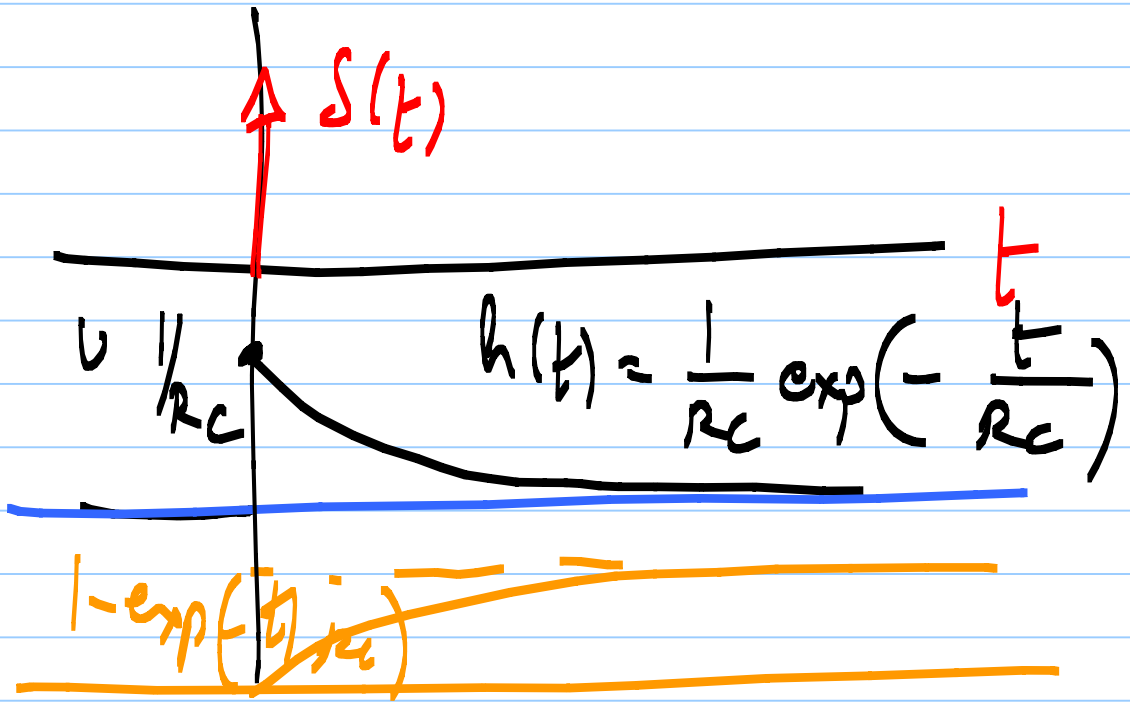

cos(ω₀t)
cos(ω₀t)
a_m(t)/2 + a_m(t)/2 cos(2ω₀t)

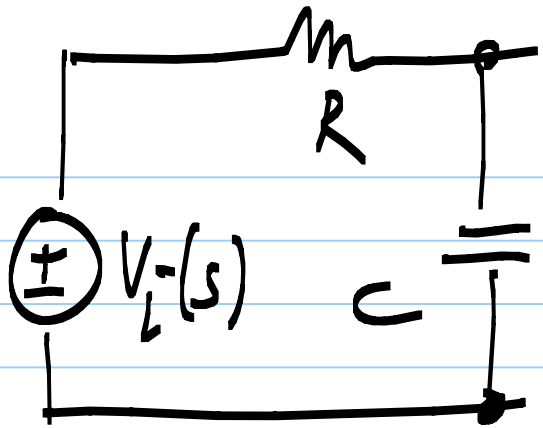
$h(t)$: inverse Laplace transform of $H(s)$

impulse response (response to $\delta(t)$)



$u(t)$





$$\frac{V_o}{V_i} = \frac{1}{1+sCR}$$

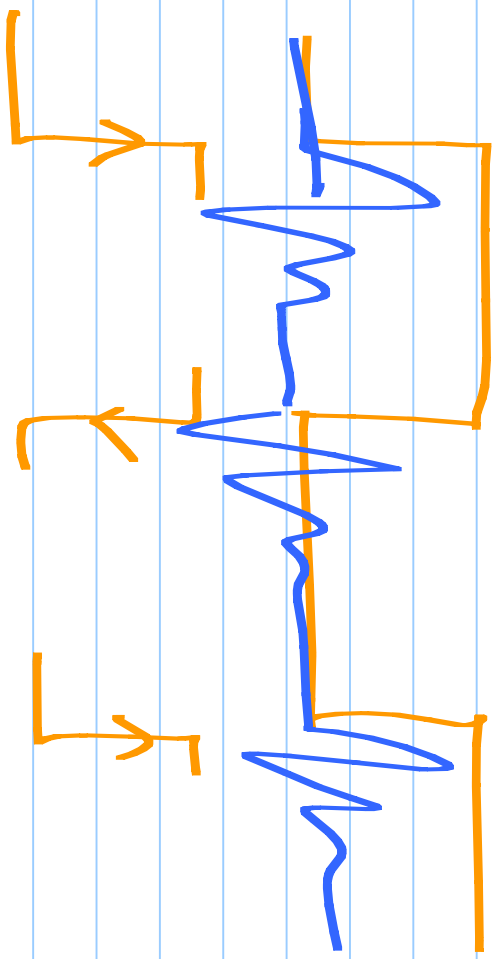
$$\frac{(1/CR)}{\{s+1/CR\}}$$

$\mathcal{L}^{-1}$

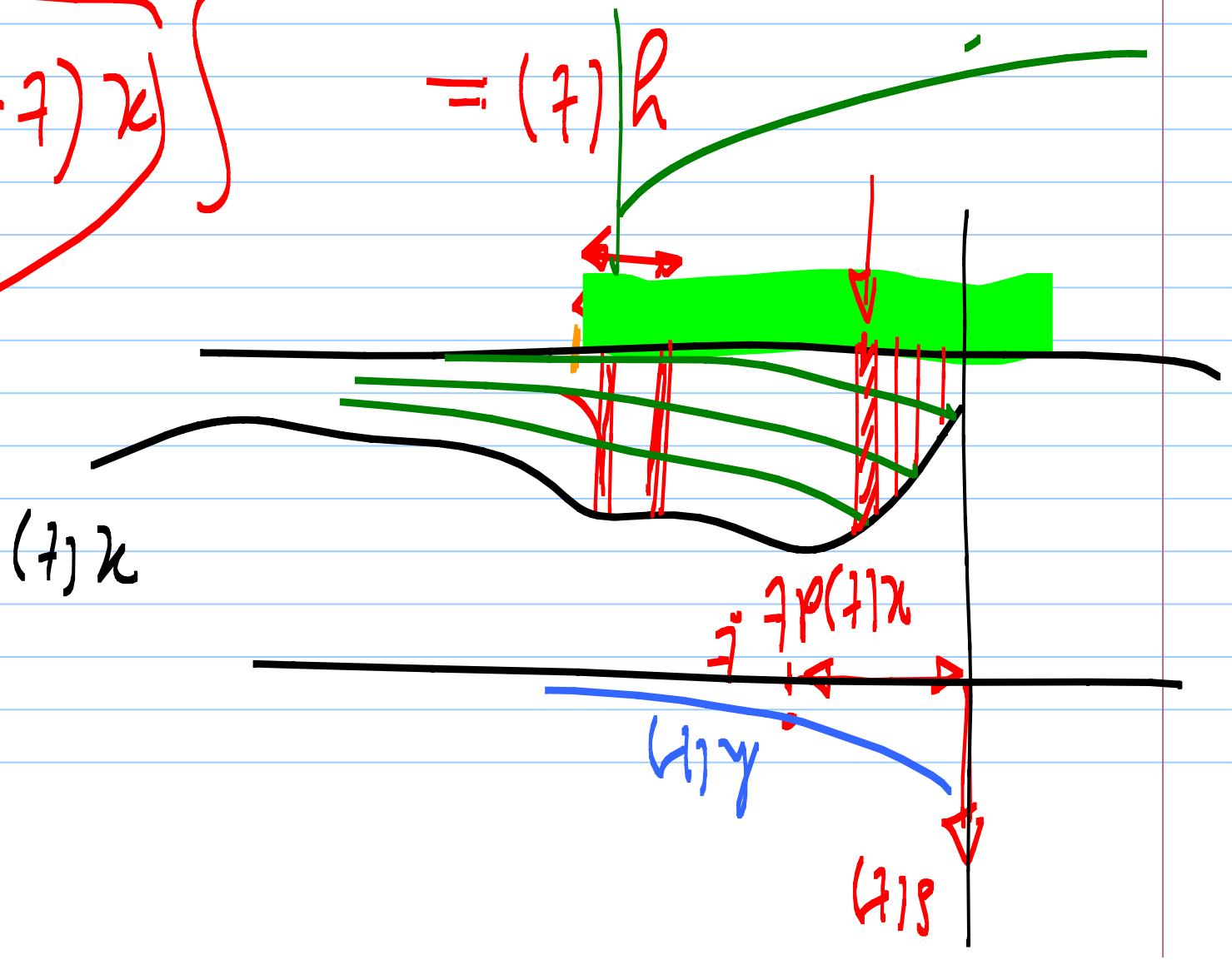
$$\frac{1}{CR}\exp(-t/RC)$$

$\frac{1}{s}$ — $H(s)$ —

$\mathcal{L}^{-1}\left(\frac{H(s)}{s}\right)$: step response



$$\int_{-\infty}^{\infty} x(\tau)\, y(t-\tau)\, d\tau = h(t)$$



$$H(s) = \frac{\blacksquare s^{M} + \blacksquare s^{M-1} + \cdots + \blacksquare s + b_0}{\blacksquare s^{N} + a_{N-1} s^{N-1} + \cdots + a_1 s + a_0}$$

$$= \blacksquare \frac{(s - z_1)(s - z_2)(s - z_3) \cdots (s - z_M)}{(s - p_1)(s - p_2)(s - p_3) \cdots (s - p_N)}$$

poles: x

Zeros: o