$\hookrightarrow$ derived from: de Moivre's formula: $e^{j\theta} \equiv \cos\theta + j\sin\theta$

$e^{-j\theta} = \cos(-\theta) + j\sin(-\theta)$

$= \cos(\theta) - j\sin(\theta)$

$\frac{e^{j\theta}+e^{-j\theta}}{2} = \cos\theta$

$\frac{e^{j\theta}-e^{-j\theta}}{2j} = \sin\theta$

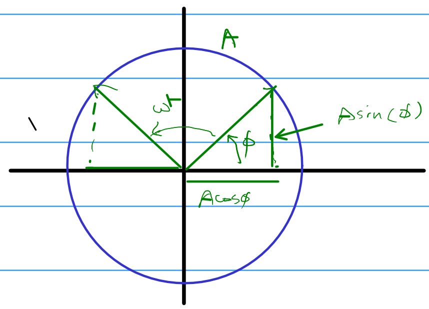
complex conjugates

$$2A\cos(\omega t+\phi) = A e^{j(\omega t+\phi)} + A e^{-j(\omega t+\phi)}$$

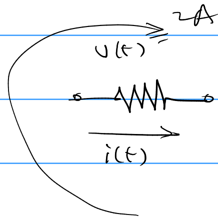
$$\overline{\alpha + j\beta} = \alpha - j\beta$$

$$= 2\,\mathrm{Re}\{A\, e^{j(\omega t+\phi)}\}$$

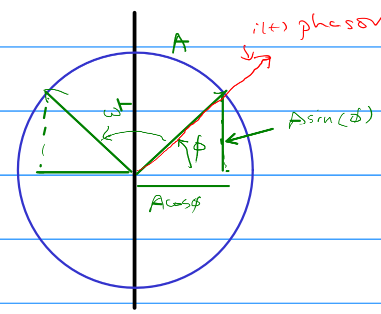
$$= 2\,\mathrm{Re}\{\underbrace{Ae^{j\phi}}_{\text{phasor}} e^{j\omega t}\}$$

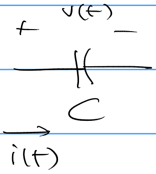


$$2A\cos(\omega t+\phi) = 2\,\mathrm{Re}\{\underline{Ae^{j\phi}}\, e^{j\omega t}\}$$



$$i(t) = \frac{v(t)}{R} = \frac{Ae^{j\theta}}{R} e^{j\omega t}$$





$$i(t) = C\frac{d}{dt}\left[2\,\mathrm{Re}\{Ae^{j\theta} e^{j\omega t}\}\right]$$

$$= 2\frac{d}{dt}\left[\mathrm{Re}\left[CAe^{j\theta}\frac{d e^{j\omega t}}{dt}\right]\right]$$

$$= 2\frac{d}{dt}\left[\mathrm{Re}\left[\underbrace{j\omega C Ae^{j\theta}}_{\text{phasor}} e^{j\omega t}\right]\right]$$

$$\frac{d}{dt}\{\mathrm{Re}(z(t))$$

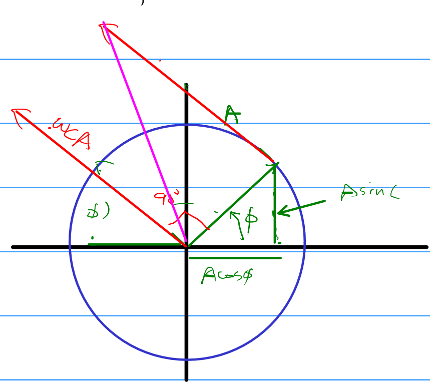
$$= \mathrm{Re}\{\frac{d}{d} z(t)\}$$

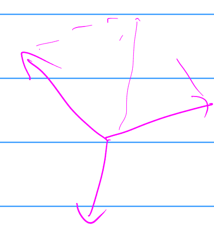
$$e^{j\pi/2} = \cos(\pi/2) + j\sin(\pi/2)$$

cap. current: $(j\omega C)\, Ae^{j\theta}$

$\omega CA\, e^{j\theta} e^{j\pi/2}$

$= \omega CA\, e^{j(\theta+\pi/2)}$





$\ulcorner\!\to Ae^{j\phi}$

$2A\cos(\omega t+\phi)$

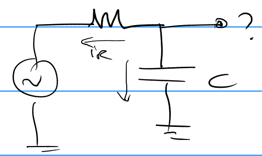
$+\quad 2B\cos(\omega t+\theta)$

$\left[Ae^{j\omega t}+Ae^{-j\omega t}\right]$ $\quad\longrightarrow\left[Be^{j\phi}e^{j\omega t}+Be^{-j\phi}e^{-j\omega t}\right]$

$\uparrow$

$2A\cos(\omega t)$ $\quad 2B\cos(\omega t+\phi)$

known



$i_R(t) =$

i_R

$$\frac{\left(\left[Be^{j\phi}e^{j\omega t}+Be^{-j\phi}e^{-j\omega t}\right]-\left[Ae^{j\omega t}+Ae^{-j\omega t}\right]\right)}{R}=\left[\frac{Be^{j\phi}}{R}-\frac{A}{R}\right]e^{j\omega t}+\left(\frac{Be^{-j\phi}}{R}-\frac{A}{R}\right]e^{-j\omega t}$$

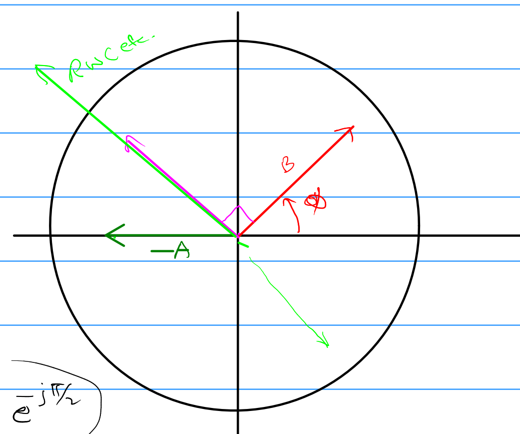
$$i_C=C\frac{d}{d}\left[\left[Be^{j\phi}e^{j\omega t}+Be^{-j\phi}e^{-j\omega t}\right]\right]$$

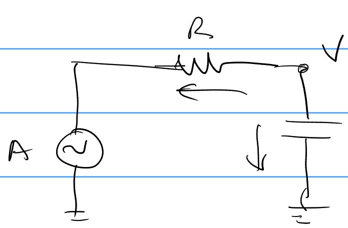
i_C

$$=C\left[\omega Be^{j(\phi+\pi/2)}e^{j\omega t}+\omega Be^{-j(\phi+\pi/2)}e^{-j\omega t}\right]$$

KCL: $\underline{\left[\frac{Be^{j\phi}}{R}-\frac{A}{R}+\omega CBe^{j(\phi+\pi/2)}\right]e^{j\omega t}+\left[\quad\text{conj}\quad\right]e^{-j\omega t}}=0$

$$\boxed{Be^{j\phi}-A+R\omega CB\,e^{\cancel{j(\phi+\pi/2)}}=0}$$





$$Z=\frac{1}{j\omega C}=\frac{-j}{\omega C}=\frac{1}{\omega C}e^{-j\pi/2}$$

$$\frac{V-A}{R}+\frac{V}{Z}=0$$

$$\Rightarrow V\left[\frac{1}{R}+\frac{1}{Z}\right]=\frac{A}{R}\Rightarrow V=\frac{A}{R\left[\frac{1}{R}+\frac{1}{Z}\right]}=\frac{A}{\left[1+\frac{R}{Z}\right]}$$

$$=V\left[1+\frac{R}{Z}\right]-A=0$$

$$\boxed{=V\left[1+\omega CRe^{+j\pi/2}\right]-A=0}\qquad\boxed{Be^{j\phi}-A+R\omega CB\,e^{\cancel{j(\phi+\pi/2)}}=}$$

$$V-A+\omega CR\,\underbrace{Be^{j\phi}}_{V}e^{j\pi/2}=0$$