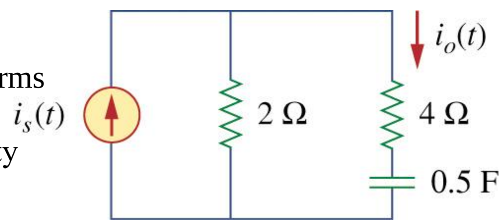
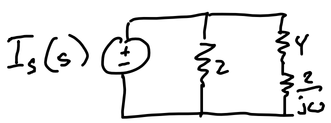
Given: The circuit to the right
Find: $i_o(t)$ if $i_s(t) = 10\sin(2t)$A using Fourier Transforms
Hint: Use integral formula to find inverse.
Tricky; use sifting property and Euler's Identity





$$I_o = I_s\left[\frac{2}{2+4+\frac{2}{j\omega}}\right]$$

$$= 10j\pi\left[\delta(\omega+2)-\delta(\omega-2)\right]\left[\frac{2}{6+\frac{2}{j\omega}}\right] \times \frac{j\omega}{j\omega}$$

$$= \frac{20j\omega(j\pi)}{6j\omega+2}\left[\delta(\omega+2)-\delta(\omega-2)\right] \qquad j^2=-1$$

Inverse FT $\quad = \dfrac{10\omega\pi}{1+3j\omega}\left[\delta(\omega-2)-\delta(\omega+2)\right]$

① Can't find in tables ☹
② Don't see any "tricks" using properties to make it look like one in the tables ☹²
③ Don't see how making it proper, or PFD will help ☹³
④ Must use integral formula for inverse

$$i_o(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} I_o(\omega)e^{j\omega t}\,d\omega$$

$$= \frac{1}{2\pi}\int_{-\infty}^{\infty} \frac{10\omega\pi}{1+3j\omega}\delta(\omega-2)e^{j\omega t} - \frac{10\omega\pi}{1+3j\omega}\delta(\omega+2)e^{j\omega t}\,d\omega$$

Use sifting property of impulse: $\int f(\omega)\delta(\omega-\omega_0) = f(\omega_0)$

$$= \frac{1}{2\pi}\left[\frac{10\cdot 2\pi}{1+3j2}e^{j2t} - \frac{10(-2)\pi}{1+3j(-2)}e^{-j2t}\right]$$

$$= \frac{10}{1+j6}e^{j2t} + \frac{10}{1-j6}e^{-j2t}$$

eval in calc in complex polar, degree mode

$$= 1.64\angle{-80^\circ}\, e^{j2t} + 1.64\angle 80^\circ\, e^{-j2t}$$

recall $\dfrac{e^{jx}+e^{-jx}}{2} = \cos x$ so get in that form

$$= 1.64e^{-j80^\circ}e^{j2t} + 1.64e^{j80^\circ}e^{-j2t}$$

$$= 1.64e^{j(2t-80^\circ)} + 1.64e^{-j(2t-80^\circ)}$$

$$= 1.64\cdot 2\left[\frac{e^{j(2t-80^\circ)} + e^{-j(2t-80^\circ)}}{2}\right]$$

$$= \boxed{3.28\cos(2t-80^\circ)\,\text{A}}$$