1310 Homework 5

① Proove that

$$A_1\cos(\omega t+\theta_1) + A_2\cos(\omega t+\theta_2) = A_3\cos(\omega t+\theta_3)$$

where the phase θ_3 and magnitude A_3 can be expressed as a single complex number

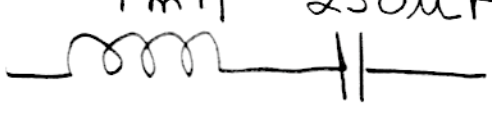
$$\left(A_1 e^{j\theta_1} + A_2 e^{j\theta_2}\right)$$

② Proove the following trig identities using complex exponentials

$$\sin 2t = 2\sin t\cos t$$

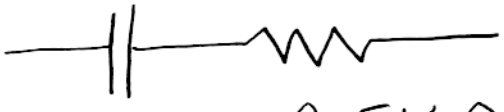
$$\cos 2t = \cos^2 t - \sin^2 t$$

③ Write an expression for the complex impedance of the circuit branch below as a function of frequency ω. At what frequency is the impedance 0 ? (in Hz)



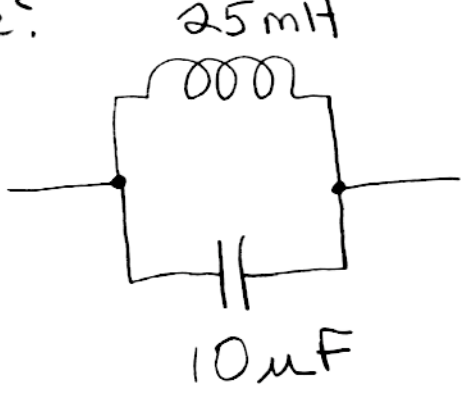
answer: 318 Hz

④ write an expression for the complex impedance of the circuit branch below as a function of frequency ω. At what frequency in Hz is the phase of the impedance $-45°$?



answer: 6.37 Hz

⑤ write an expression for the complex impedance of the circuit branch below as a function of frequency ω. At what frequency in Hz is the magnitude of the impedance infinite?



answer: 318 Hz

⑥ what is the magnitude of the impedance in question 5 at 0 Hz? at ∞ Hz?

answer: 0, 0