ECE 210 Review
Midterm Two Fall 2024

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1 [25 points] The three parts of this problem can be solved independently.

1. Determine the phasor of the sinusoidal signal

$$f(t) = 10 \sin\left(\frac{\pi}{4}t - \frac{3\pi}{4}\right).$$

Express it both in polar and rectangular. **(5 points)**

(a) Polar:

(b) Rectangular:

2. Determine the phasor of the sinusoidal signal

$$f(t) = 4\cos\left(5t + \frac{\pi}{4}\right) + 12\cos\left(t + \frac{7\pi}{4}\right).$$

Express it in either polar or rectangular form. **(5 points)**

3. Given the LTI system with frequency response

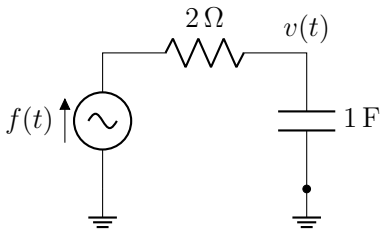
$$H(\omega) = \frac{2}{12 + j\omega}$$

and the input

$$f(t) = 7 + \sin\left(5t + \frac{\pi}{2}\right) + \cos\left(12t + \frac{\pi}{4}\right),$$

determine the output $y(t)$. **(25 points)**

2 [15 points] Consider the circuit shown below.



For $t > 0$, the source voltage is

$$f(t) = 4e^{-t}u(t) \text{ V},$$

and the capacitor has initial value $v(0^-) = 1$ V.

1. Derive the differential equation (ODE) governing the capacitor voltage $v(t)$ for $t > 0$. **(7 points)**

2. Solve for $v(t)$ for $t > 0$, using the initial condition. **(8 points)**