Homework 5
Due: Friday, March 2nd, 2023 by 7PM.

Note: In order to receive full credit, you must show your work and carefully justify your answers. The correct answer without any work will receive little or no credit.

1. Find the phasor form of the following functions:
    A. $v(t) = 155 \cos (377t - 25°)$ V
    B. $v(t) = 5 \sin (1000t - 40°)$ V
    C. $i(t) = 10 \cos (10t + 63°) + 15 \cos (10t - 42°)$ A
    D. $i(t) = 460 \cos (500\pi t - 25°) - 220 \sin (500\pi t + 15°)$ A

$A.$ $\boxed{155e^{-25j}}$

$B.$ $5\sin(1000t - 130°) = \boxed{5e^{-130j}}$

$C.$ $10e^{63j} + 15e^{-42j} = \boxed{15.73e^{-411i}}$

$D.$ $-220\cos(500\pi t - 75) \rightarrow 460e^{-25j} - 220e^{-75j} = \boxed{360.42e^{2.88i}}$

2. Determine the instantaneous time functions corresponding to the following phasors:
    A. $I1 = 6∠60°$A at $f = 60$Hz
    B. $V1 = -2∠-30°$V at $f = 1$kHz
    C. $I2 = j3$A at $f = 1$MHz
    D. $V2 = -(3 + j4)$V at $f = 10$kHz

$A.$ $6\cos(\omega t + 60) \longrightarrow \boxed{6\cos(120\pi t + 60)}$
$\omega = 60 \cdot 2\pi = 120\pi$

$B.$ $2∠150° \rightarrow \boxed{2\cos(2000\pi t + 150)}$

$\omega = 1000 \cdot 2\pi = 2000\pi$

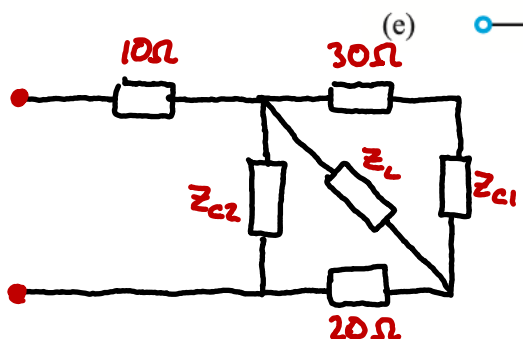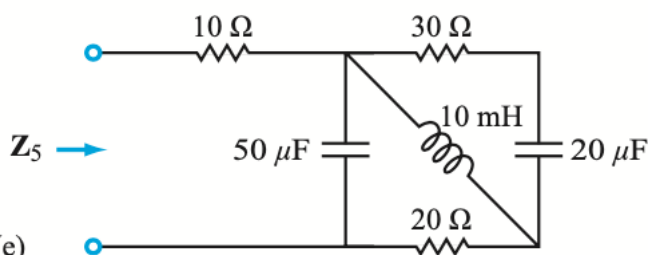$C.$ $3e^{\frac{\pi}{2}i} \rightarrow \boxed{3\cos(1000000\pi t + 90)}$

$\frac{\pi}{2} \cdot \frac{180}{\pi} \rightarrow 90°$ $1MHz \cdot 2\pi = 2\pi MHz$

D $5e^{-2.21i} \rightarrow \boxed{5\cos(20000\pi t - 126.87)}$

$-2.21 \cdot \frac{180}{\pi} \rightarrow -126.87$

$10kHz \cdot 2\pi = 20\pi kHz$

3. Determine the equivalent impedance Z5. Assume w = 400 rad/s.

$10\,\Omega$ $30\,\Omega$

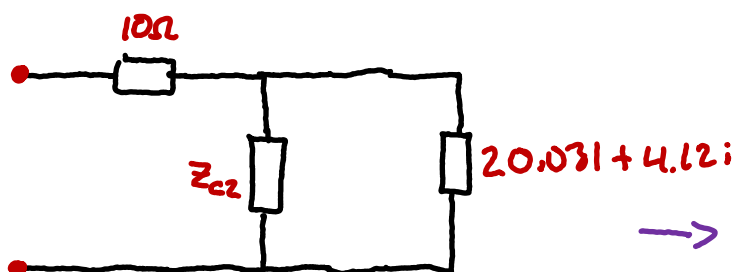$Z_5 \rightarrow$ $50\,\mu F$ $10\,mH$ $20\,\mu F$
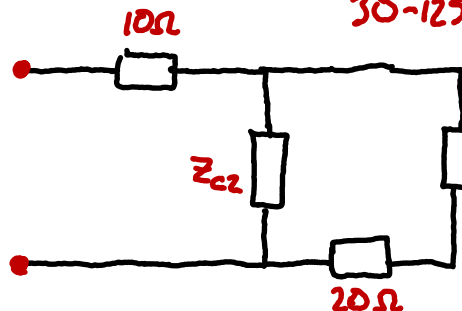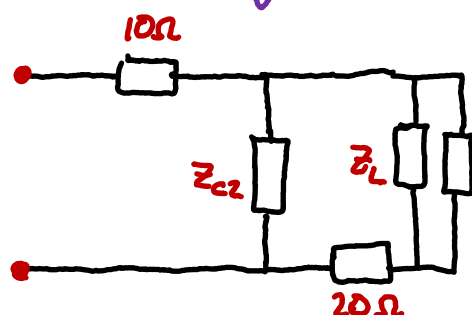
$20\,\Omega$

(e)

$$Z_{c1} = \frac{-j}{(400)(20 \cdot 10^{-6})} = -125j$$

$$Z_{c2} = \frac{-j}{(400)(50 \cdot 10^{-6})} = -50j$$

$$Z_L = (10 \cdot 10^{-3})(400)j = 4j$$

$$\frac{(30 - 125j)(4j)}{30 - 125j + 4j} = 0.031 + 4.12i$$

$$\frac{(20.031 + 4.12i)(-50i)}{20.031 + 4.12i - 50i} = \frac{19.98}{-4.23i} = 19.98 - 4.23i$$

$$29.98 - 4.23i$$