Due Sunday, Apr. 20, 2025 by 11:59 p.m.

NOTE: This is only the "handwritten" portion of Homework 12. There are also problems you must do online via the Mastering site. For this handwritten portion you must submit a PDF scan of your work at Canvas. Please ensure your work is contained in a single file and is legible.

1. For each of the following, provide the corresponding phasor. Your answer should be a complex number in *polar form*. You can use either $re^{j\theta}$ or $r\angle\theta$ notation.

   (a) $3\cos(10^5\pi t) + 4\cos(10^5\pi t)$

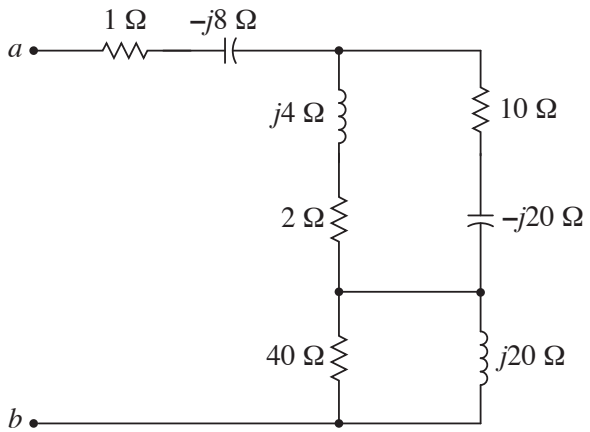
   (b) $3\cos(10^5\pi t) + 4\sin(10^5\pi t)$

   (c) $3\cos(10^5\pi t) + 4\sin(10^5\pi t - \pi/2)$

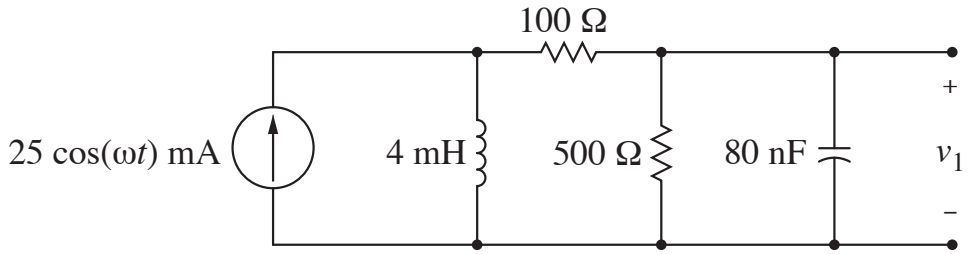
   (d) $3\cos(10^5\pi t + \pi/3) + 4\sin(10^5\pi t - \pi/3)$

   (e) $3\cos(10^5\pi t + \pi) + 4\sin(10^5\pi t)$

2. For the elements below, what is the equivalent impedance between the terminals a and b?

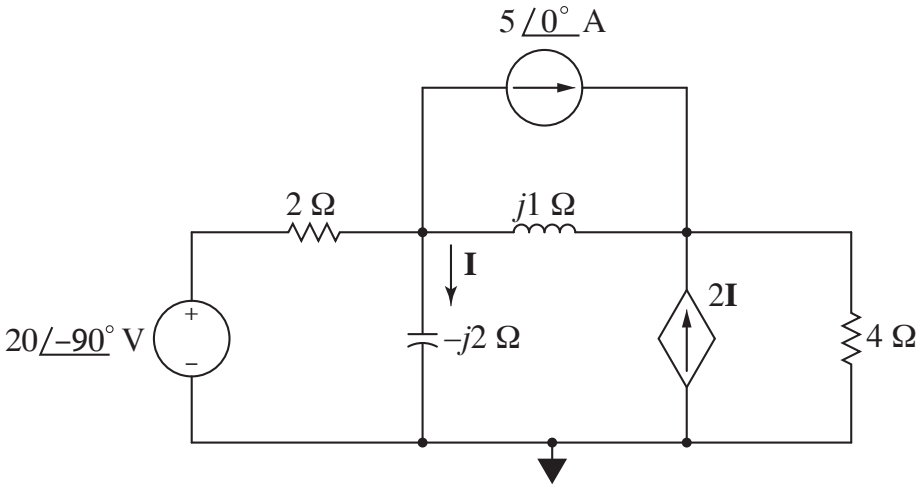


3. For the circuit below, the frequency ω is $50{,}000$ rad/s. The circuit is in sinusoidal steady state. What is the voltage $v_1(t)$?



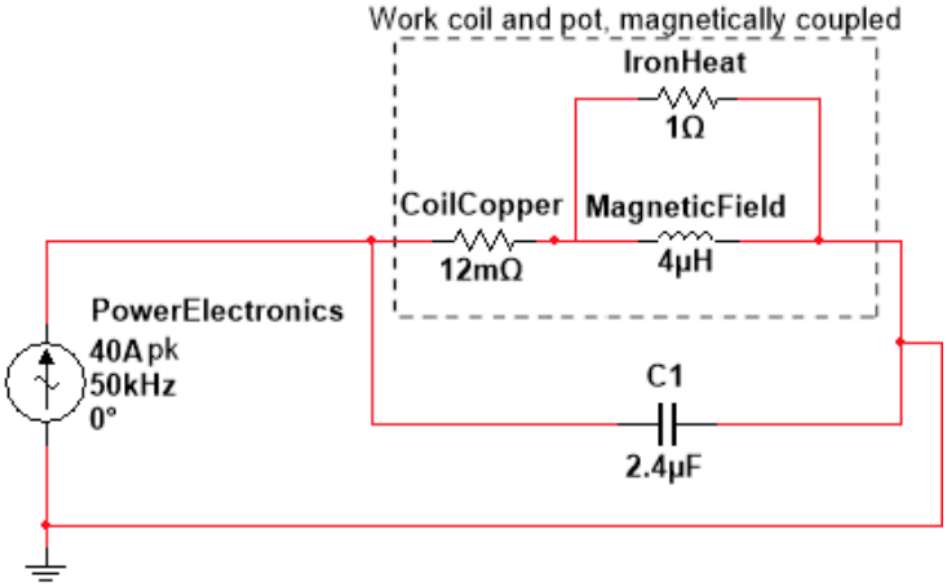
(continued)

4. For the circuit below, find the current **I**. You can use either nodal analysis or mesh analysis (or both to check your work!).



The following problem is courtesy of Prof. Brian Faulkner of the Milwaukee School of Engineering.

5.  Induction cooktops heat iron pots by inducing eddy currents in the pot's bottom, using intense, high frequency currents in a magnetic work coil. A (simplified) equivalent circuit model for a small induction rice cooker is shown below.



(a) Redraw the circuit in the frequency domain, making series and parallel relationship as clear as possible.

(b) The capacitor C_1 is used primarily to cancel the reactance of the work coil's magnetic field, thus easing the burden on the power electronics. What *peak* voltage must the capacitor be rated to survive without breaking when the source has a peak amplitude of 40 A at a frequency of 50 kHz.