Name _____

EE 3340
Final Exam
Spring Semester 2022

## Show all work *neatly and completely.*
Credit will not be given for work not shown.

There are 7 problems provided here. Choose any 6 to submit for grading. Each of the 6 problems you submit will be worth a maximum of 25 points, making 150 points the maximum total possible score on the exam. There will be very little partial credit; take your time and ***check your work***.
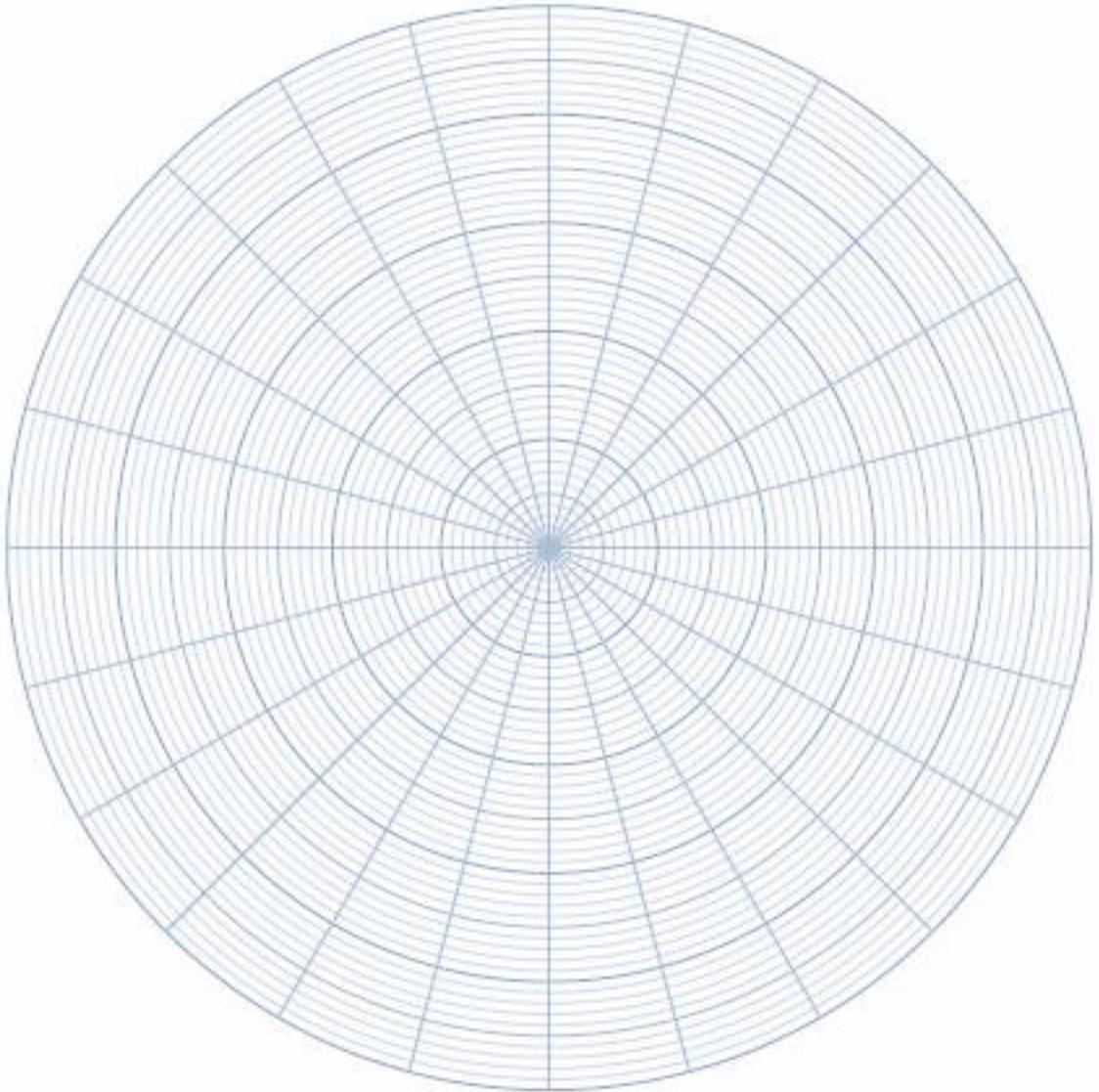
1. Determine $\mathbf{V_x}$ in polar form if $\omega = 2$ rad/s.
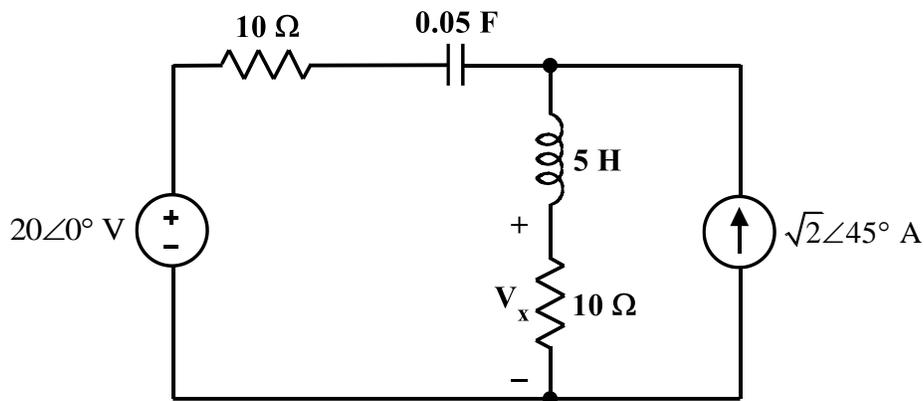
2. Determine the input impedance, $\mathbf{Z}_{in}$, in rectangular (Cartesian) form if $\omega = 5$ rad/s.
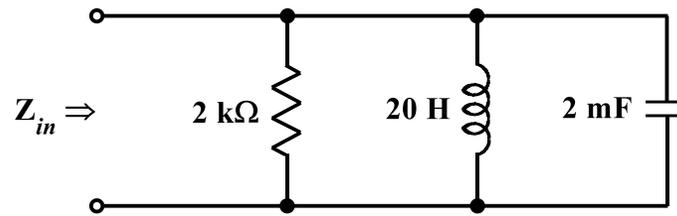
3. Given two signals, $x(t) = 2\sin(\omega t - 30°)$ and $y(t) = 3\cos(\omega t - 45°)$:

   a. Accurately sketch a phasor diagram showing the proper length and orientation of each of these two signals.

   b. What is the phase angle of $x(t)$ **with respect to** $y(t)$?

4. As a final step in the design process, the output stage of a radio amplifier must be matched to the impedance of its speaker by using an impedance-matching transformer as shown below. The selected speaker has input impedance equal to 4Ω, and the amplifier requires a load impedance of 2500 Ω for optimum performance. Assume the transformer is ideal, and determine the necessary turns ratio to accomplish the desired match
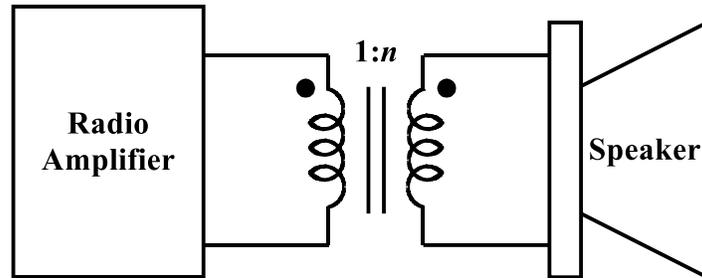
5. Determine the voltage transfer function of the filter circuit shown below and classify the filter as LP, HP, BP or BS. *Clearly* explain your reasoning.
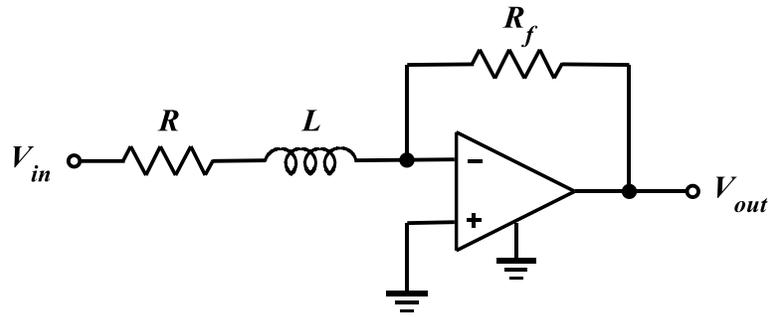
6. A balanced three-phase distribution system is shown below. Determine the value of the neutral current, $\mathbf{I}_n$, in rectangular (Cartesian) form.

$\mathbf{I}_a$

$+$

$120\angle 0°$ V

$j10\ \Omega$

$\mathbf{I}_n$

$j10\ \Omega$

$120\angle -120°$ V

$120\angle 120°$ V

$\mathbf{I}_b$

$j10\ \Omega$

$\mathbf{I}_c$
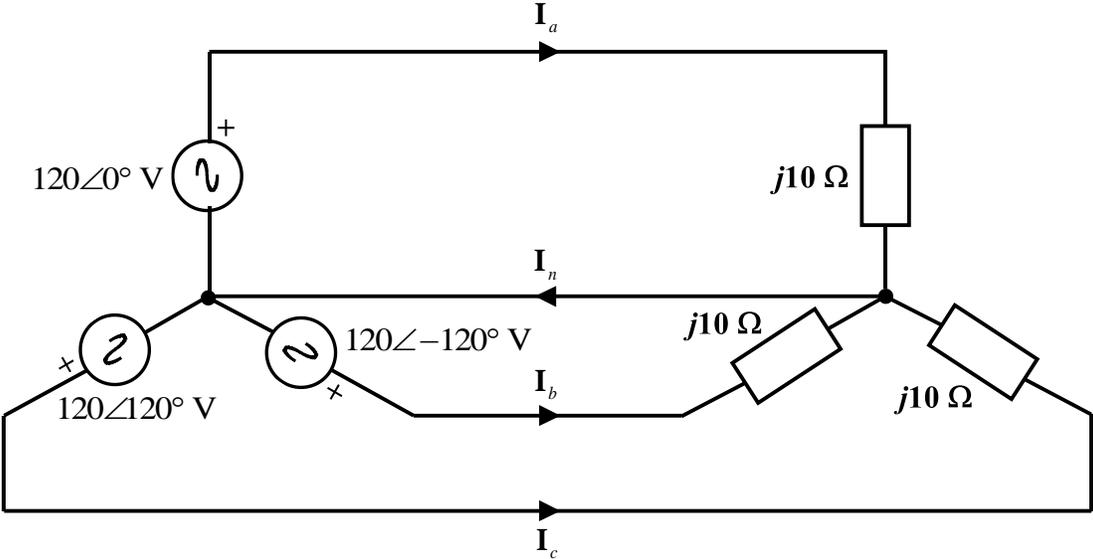
7. The waveform shown below is periodic with $T = 10$ s. Determine the *average and effective* values of $v(t)$.

$v(t)$, V

100
90
80
70
60
50
40
30
20
10

t, s

-10
-20
-30
-40
-50
-60
-70
-80
-90
-100

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20