ECEN 615 Problem Set #1 **Fall 2025**
Due 9/11/25

1. Use the Newton-Raphson method to find one solution to the polynomial equation $f(x) = x^3 - 9x^2 - 14x - 20 = 0$. Start with an intial guess of 0 and continue until the mismatch is below a tolerance of $\varepsilon = 0.001$.

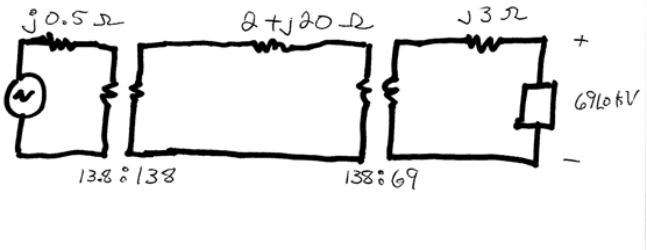
2. The following nonlinear equations contain terms that are often found in the power flow equations.

   $f_1(\mathbf{x}) = 10\, x_1 \sin x_2 + 1.2 = 0$

   $f_2(\mathbf{x}) = 10\, (x_1)^2 - 10\, x_1 \cos x_2 + 0.4 = 0$

   Using the Newton-Raphson method, determine a solution. Start with an initial guess of $x_1(0) = 1$ and $x_2(0) = 0$ radians, and a stopping criteria of $\varepsilon = 10^{-4}$.

3. Assume the below diagram models a balanced three-phase system in which a 100 + j50 MVA load (total for all three phases) is supplied at 69 kV (line-to-line). First, redraw the network using a per unit representation with a 100 MVA base, and a 69 kV voltage base for the load. Then solve the circuit to determine how much real and reactive power is being supplied by the generator (source) on the left?



4. Using PowerWorld Simulator and the case ECEN_615_2025_HW1, give the bus numbers and circuit of two transmission lines that when opened cause at least one other line to be overloaded.

5. Search the *IEEE Transactions on Power Systems* to find an important power flow paper that has not been mentioned in class (and doesn't have Overbye as an author). Write and turn in an approximately one page extended summary of the paper including explaining why you think it is an important paper. This should be a minimum of 750 words. Also, for the on campus students be prepared to get a thirty second "elevator pitch" on why this is an important paper during class on Tuesday September 16.