2022A6 REACTANCE

ANSWERS

Level 1: To solve this question, we need to use the equation to find capacitive reactance.

$$X_c = -\frac{1}{2\pi f C}$$

We were given both values; we know that f is equal to 60 Hz, and C is equal to $2*10^{-6}$ farads. Let's plug those values into that equation.

$$X_c = -\frac{1}{2 * \pi * 60 * (2 * 10^{-6})}$$

$$X_c = -\frac{1}{0.000754}$$

$$X_c = -1{,}326\ \Omega$$

Wow! We get a huge reactance from a small capacitor. Remember, this reactance is negative. Usually, we want zero reactance in our system, so any amount of reactance, positive or negative, will mean that we are wasting power.

Level 2: Solving this question requires setting up an equation where the combination of inductive reactance and capacitive reactance balances out to give zero total reactance.

$$0 = X_L + X_c$$

Now, let's replace those reactance values with the equations from earlier.

$$0 = 2\pi f L + -\frac{1}{2\pi f C}$$

Now we can do some slight shifting of the variables to make everything simpler.

$$\frac{1}{2\pi f C} = 2\pi f L$$

At this point, we've completed a small proof! We now know that whenever we want a zero reactance system, the capacitive reactance must be exactly equal to the inductive reactance.

We can now substitute in the values given to us to find the inductance we want.

$$\frac{1}{2 * \pi * 50 * (12 * 10^{-3})} = 2 * \pi * 50 * L$$

$$0.265 = 314.16 * L$$

$$0.000844\, H = L$$

A small inductance makes a lot of sense. We put in a small capacitor, so we need a small inductor to balance out that capacitive reactance.

Knowing what creates reactance is important, because reactance plays a big part in power factor. A power factor with less reactance, and therefore less reactive power, means a more efficient load!