#1 (a.) $V_{peak} = A_0$ and $V_{rms} = \frac{V_{peak}}{\sqrt{2}}$

$\therefore \boxed{V_{rms} = \frac{A_0}{\sqrt{2}}}$

(b.) $I_{max} = \frac{\Delta V_{peak}}{X_c}$ where $X_c = \frac{1}{\omega C}$

$\Rightarrow I_{max} = \omega C A_0$

$\therefore \boxed{C = \frac{I_{max}}{\omega A_0}}$

#2 $\Delta V_{p-p} = 2\Delta V_{peak}$

$I_{max} = \frac{\Delta V_{peak}}{Z} = \Delta V_{peak}\left[R^2 + (X_c - X_L)^2\right]^{-1/2}$ and $\omega = 2\pi f$

with $X_c = \frac{1}{2\pi f C}$ and $X_L = 2\pi f L$

(a.) $\boxed{\Delta V_{max}^{AB} = \frac{1}{2}\Delta V_{p-p} R\left[R^2 + \left(\frac{1}{2\pi f C} - 2\pi f L\right)^2\right]^{-1/2}}$

(b.) $\boxed{\Delta V_{max}^{BC} = \pi \Delta V_{p-p} f L\left[R^2 + \left(\frac{1}{2\pi f C} - 2\pi f L\right)^2\right]^{-1/2}}$

(C.) $\boxed{\Delta V_{max}^{CD} = \frac{1}{4\pi}\frac{\Delta V_{p-p}}{fC}\left[R^2 + \left(\frac{1}{2\pi f C} - 2\pi f L\right)^2\right]^{-1/2}}$

(d.) $X_{tot}^{BD} = |X_c - X_L|$

$\therefore \boxed{\Delta V_{max}^{BD} = \Delta V_{p-p}\frac{\left|\frac{1}{4\pi f C} - \pi f L\right|}{\sqrt{R^2 + \left(\frac{1}{2\pi f C} - 2\pi f L\right)^2}}}$

#3 (a.) $X_L = \omega L$

$\therefore \boxed{X_L = 2\pi f L}$

(b.) $I_{rms} = \dfrac{\Delta V_{rms}}{X_L}$

$\therefore \boxed{I_{rms} = \dfrac{\Delta V_{rms}}{2\pi f L}}$

#4 for $X_c = X_L$ we have $\dfrac{1}{\omega C} = \omega L$

$\Rightarrow \omega = \dfrac{1}{\sqrt{LC}}$ where $\omega = 2\pi f$

$\therefore$ for both parts (a.) and (b.)

$\boxed{f = \dfrac{1}{2\pi\sqrt{LC}}}$

#5 $\omega_0 = 2\pi f_0$

$X_c = X_L$

$\Rightarrow LC = \dfrac{1}{\omega_0^2}$

$\Rightarrow C = \dfrac{1}{L\omega_0^2}$

$\therefore \boxed{C = \dfrac{1}{4\pi^2 f_0^2 L}}$

#6 (a.) $\boxed{X_L = 2\pi f L}$

(b.) $\boxed{X_C = \frac{1}{2\pi f C}}$

(c.) $V_{max} = Z I_{max}$

$\therefore \boxed{Z = \frac{V_{max}}{I_{max}}}$

(d.) $\phi = \tan^{-1}\left(\frac{X_L - X_C}{R}\right)$

$\therefore \boxed{\phi = \tan^{-1}\left(\frac{2\pi f L - \frac{1}{2\pi f C}}{R}\right)}$

#7

$$R_{eq} = \left(\frac{N_1}{N_2}\right)^2 R_L$$

$$V_1 = \frac{N_1}{N_2} V_L \Rightarrow I_1 = \frac{V_1}{R_{eq}} = \frac{N_1/N_2 \, V_L}{(N_1/N_2)^2 R_L} = \frac{N_2}{N_1} \frac{V_L}{R_L}$$

$$\Rightarrow \Delta V_{drop} = V_s - V_1 = V_s - \frac{N_1}{N_2} V_L$$

$$\therefore R_s = \frac{\Delta V_{drop}}{I_1} = \frac{V_s N_1 R_L}{N_2 V_L} - R_L$$

$$\therefore \boxed{R_s = R_L\left(\frac{N_1}{N_2}\frac{V_s}{V_L} - 1\right)}$$

#8

(a.) $V_{rms} = Z I_{rms}$

$$\therefore \boxed{Z = \frac{V_{rms}}{I_{rms}}}$$

(b.) $\dfrac{X_L - X_R}{R} = \tan\phi$ and $R^2 = Z^2 - (X_L - X_c)^2$

$$\Rightarrow \frac{(X_L - X_c)^2}{Z^2 - (X_L - X_c)^2} = \tan^2\phi$$

$$\Rightarrow (X_L - X_c)^2 = Z^2 \tan^2\phi - (X_L - X_c)^2 \tan^2\phi$$

$$\Rightarrow (X_L - X_c)^2 (1 + \tan^2\phi) = Z^2 \tan^2\phi \quad \text{where } 1 + \tan^2\phi = \sec^2\phi$$

$$\Rightarrow (X_L - X_c)^2 = Z^2 \frac{\tan^2\phi}{\sec^2\phi} = Z^2 \frac{\sin^2\phi}{\cos^2\phi} \cos^2\phi$$

$$\therefore (X_L - X_c)^2 = Z^2 \sin^2\phi$$

$$\therefore X_L - X_c = Z \sin\phi$$

$$\therefore \boxed{X_L - X_c = \frac{V_{rms}}{I_{rms}} \sin\phi}$$