ETA Common Formulas

<u>Conversion Factors:</u>

π (Pi) = 3.14 **2π = 6.28**
π^2 = 9.87 **logπ = 0.497**
1 meter = 3.28 feet
1 inch = 2.54 centimeters
1 radian = 57.3°

<u>Resonant frequency formulas</u>
Where f is in kHz, L is in microhenries, C is in microfarads

$$f_{kHz} = 159.2 \div \sqrt{LC}$$

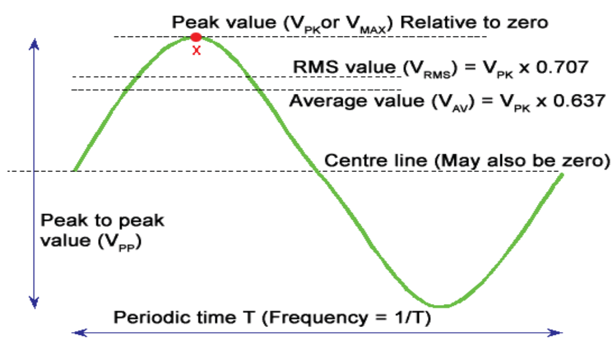
$$f_{resonant} = \frac{1}{2\pi\sqrt{LC}}$$

<u>Frequency & Wavelength formulas</u> ***f = frequency, λ = wavelength***
0.5λ = 180° = half wave 0.25λ = 90° = quarter wave

$$f_{kHz} = (3x10^8) \div \lambda meters \quad \text{or} \quad f_{MHz} = 984 \div \lambda feet$$

$$\lambda meters = (3x10^8) \div f_{kHz} \quad \text{or} \quad \lambda feet = 984 \div f_{MHz}$$

<u>Sine wave conversion</u> (RMS = root mean square).
Effective value (RMS) = 0.707 x Peak Value = 1.11 x Average Value
Peak Value = 1.414 x Effective Value (RMS) = 1.57 x Average Value
Average Value = 0.637 x Peak Value = 0.9 x Effective Value (RMS)
Identify: Waveform, Peak (amplitude), RMS, 1 cycle over time period (frequency), Peak to peak, and practical average.



<u>Voltage gain in decibels</u>

Gain dB = 20 log (Vout / Vin)

<u>Ratio of 2 power levels in decibels</u>

$$\textbf{Gain dB} = 10 \log (P_1 \div P_2)$$

<u>Resistors in series</u>

$$R = R_1 + R_2 + R_3...$$

<u>Resistors in parallel</u>

$$1 / R = (1 / R_1) + (1 / R_2) + (1 / R_3)...$$

<u>Inductors connected in series</u>

$$L = L_1 + L_2 + L_3 + ...$$

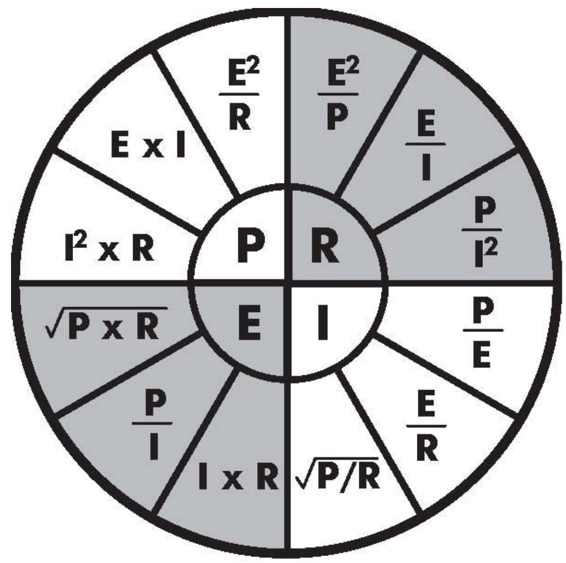
<u>Inductors connected in parallel</u>

$$1 \div L = (1 \div L_1) + (1 \div L_2)...$$

<u>Reactance of inductors</u>
where X_L is reactance, ***f*** is frequency, and **L** is inductance

$$X_L = 2 \times \pi \times f \times L$$

Ohm's Law



E=Voltage I=Current
P=Power R=Resistance

P = I * E, the power being dissipated by the resistor is a product of the current and the applied voltage.

<u>Time constants</u>
T (Greek Tau), R (ohms), C (microfarads), L (microhenries)

RL circuit: **1 T (sec) = L** (μH) ÷ **R** (Ω)

RC circuit: **1 T (sec) = R** (Ω) × **C** (μf)

<u>How to Compute Charge or Quantity of Electricity</u>
where **Q** is the charge (in coulombs), **C** is the capacitance (in farads), and **V** is the potential difference (in volts).

Q = C × V

<u>Energy Storage in a Capacitor</u>
where **W** is the energy (in Joules), **C** is the capacitance (in farads), and **V** is the potential difference (in volts).

$$W = ½ C \times V^2$$

<u>Capacitors connected in parallel</u>

$$C = C_1 + C_2 + C_3 + ...$$

<u>Capacitors connected in series</u>

$$1 \div C = (1 \div C_1) + (1 \div C_2) + (1 \div C_3)...$$

<u>Reactance of capacitors</u>

$$X_C = 1 \div (2 \times \pi \times f \times C)$$

<u>Impedance Formulas</u> for a Series Circuit

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$ where Z is impedance

<u>Impedance Formulas</u> for R and X in Parallel

$$Z = \frac{RX}{\sqrt{R^2 + X^2}}$$

<u>Battery internal resistance</u>

$$V_{out} = EMF - V_{terminal}$$