

AC Source	
Time Domain Function	Phasor Format
$v(t) = V_M \times \sin(\omega t + \theta_v)^{(V)}$	$V_M \angle \theta$
Symbol	Designates
V_M	Magnitude/Amplitude
ω	Angular Frequency
t	Instantaneous Time
θ	Phase Angle
$^{(V)}$	Measurement in Volts

Instantaneous Value Of A Sine Wave	
Degree Approach	Radian Approach
$v = V_{pk} \times \sin(\theta)$	$v = V_{pk} \times \sin(\omega t)$

Note: Make sure calculator is in appropriate mode.

Degrees	Radians
$\text{deg} = \text{rad} \cdot \frac{180}{\pi}$	$\text{rad} = \text{deg} \cdot \frac{\pi}{180}$

Sine Wave Magnitude Conversions				
	P-P x	Pk x	rms x	ave x
P-P =	1.0	2.0	2.828	3.14
Pk =	0.5	1.0	1.414	1.57
rms =	0.3535	0.707	1.0	1.11
ave =	0.3185	0.637	0.9	1.0

Largest ← $\frac{P-P}{P-P} \frac{Pk}{Pk} \frac{rms}{rms} \frac{ave}{ave}$ → Smallest

Cycle Time (Period)/ Frequency	
$T = \frac{1}{f}$	Cycle Time
$f = \frac{1}{T}$	Frequency

Angular Frequency
$\omega = 2 \times \pi \times f$

Time Domain / Phasor Format Conversion	
$[v(t) = V_M \times \sin(\omega t \pm \theta)] = [V_S = V_{RMS} \angle \theta]$	
$V_M = \sqrt{2} \times V_S$	Magnitude
$V_{RMS} = \frac{V_{PK}}{\sqrt{2}}$	Magnitude

Circuit Formulas

Phase / Time	
$\frac{\theta}{360^\circ} = \frac{t}{T_C}$	Relationship
$\theta = 360^\circ \times \frac{t}{T_C}$	Phase Angle
$t = T_C \times \frac{\theta}{360^\circ}$	Instantaneous Time
$T_C = t \times \frac{360^\circ}{\theta}$	Cycle Time (Period)
$360^\circ = \theta \times \frac{T_C}{t}$	Complete Cycle

	Resistors	Inductors	Capacitors
$f =$	$v = i$	$v = i$	$v = i$
$f_r =$	 	$\frac{1}{2 \times \pi \times \sqrt{LC}}$	
$\theta_v =$	θ_i	$\theta_i + 90^\circ$	$\theta_i - 90^\circ$
$\theta_i =$	θ_v	$\theta_v - 90^\circ$	$\theta_v + 90^\circ$
$X =$	 	$\omega \times L$	$\frac{1}{\omega \times C}$
$Z =$	$R \angle 0^\circ$	$X_L \angle +90^\circ$	$X_C \angle -90^\circ$
$Y =$	$\frac{1}{R}$	$\frac{1}{Z_L}$	$\frac{1}{Z_C}$

Ohm's Law		
$E = IR$	$I = P/E$	$R = E/I$
$E = P/I$	$I = E/R$	$R = E^2/P$
$E = \sqrt{PR}$	$I = \sqrt{P/R}$	$R = P/I^2$

Watt's Law		
DC	AC	
$P = EI$	$P_R = V_T \times I_T \times \cos(\theta_z)^{(W)}$	Resistive (True Power)
$P = I^2 R$	$P = P_x = V_T \times I_T \times \sin(\theta_z)^{(VAR)}$	Reactive
$P = E^2 / R$	$S = P_{APP} = V_T \times I_T ^{(VA)}$	Apparent (Virtual Power)

Power Factor	Quality
$PF = \frac{P_R}{P_{APP}}$	$Q = \frac{P_x}{P_R}$
$PF = \cos(\theta_z)$	$\leftarrow \frac{Q}{\text{Quality}} \rightarrow$ Low Quality \leftarrow High Quality \rightarrow

Series Circuits		
V_T	$V_1 + V_2 + \dots + V_n$	
V_n	$V_S \times \left(\frac{R_n}{R_T}\right)$	
I_T	$I_1 = I_2 = I_n$	
R_T	$R_1 + R_2 + \dots + R_n$	
Z_T	$Z_1 + Z_2 + \dots + Z_n$	$\frac{1}{Y_T}$
Y_T	$\frac{1}{Z_T}$	$Y_1 + Y_2 + \dots + Y_n$
P_T	$P_1 + P_2 + \dots + P_n$	

Parallel Circuits				
V_T	$V_1 = V_2 = V_n$			
I_T	$I_1 + I_2 + \dots + I_n$			
I_n	$I_S \times (R_T / R_n)$			
R_T	All Ckts	2 Branch	Equal R	Y_T
	$\frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \dots + \frac{1}{R_n}}$	$\frac{R_1 R_2}{R_1 + R_2}$	$\frac{R_1}{R_n}$	
Z_T	$\frac{1}{\frac{1}{Z_1} + \frac{1}{Z_2} + \dots + \frac{1}{Z_n}}$		$\frac{Z_1 Z_2}{Z_1 + Z_2}$	$\frac{Z_1}{Z_n}$
	$\frac{1}{Z_T}$		$Y_1 + Y_2 + \dots + Y_n$	
P_T	$P_1 + P_2 + \dots + P_n$			

Transformers			
Voltage		Current	
$\frac{N_p}{N_s} = \frac{V_p}{V_s}$	Turn Ratio	$\frac{N_p}{N_s} = \frac{I_s}{I_p}$	Turn Ratio
$V_p = V_s \frac{N_p}{N_s}$	Primary Voltage	$I_p = I_s \frac{N_s}{N_p}$	Primary Current
$V_p = V_s \frac{N_p}{N_s}$	Secondary Voltage	$I_s = I_p \frac{N_p}{N_s}$	Secondary Current

Impedance		
$Z_p = Z_s \left(\frac{N_p}{N_s}\right)^2$	Primary Impedance	$Z_s = Z_p \left(\frac{N_s}{N_p}\right)^2$
		Secondary Impedance