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# AC Power Formulas

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# List of 12 AC Power Formulas

## AC Power

### 1) Complex Power

$$\text{fx } S = \sqrt{P^2 + Q^2}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

$$\text{ex } 270.5199\text{VA} = \sqrt{(235\text{W})^2 + (134\text{VAR})^2}$$

### 2) Complex Power given Power Factor

$$\text{fx } S = \frac{P}{\cos(\Phi)}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

$$\text{ex } 271.3546\text{VA} = \frac{235\text{W}}{\cos(30^\circ)}$$

### 3) Power in Single-Phase AC Circuits

$$\text{fx } P = V \cdot I \cdot \cos(\Phi)$$

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

$$\text{ex } 236.4249\text{W} = 130\text{V} \cdot 2.1\text{A} \cdot \cos(30^\circ)$$

### 4) Power in Single-Phase AC Circuits using Current

$$\text{fx } P = I^2 \cdot R \cdot \cos(\Phi)$$

[Open Calculator !\[\]\(83bbbd261710c59db0214aa27b2edc0d\_img.jpg\)](#)

$$\text{ex } 229.1503\text{W} = (2.1\text{A})^2 \cdot 60\Omega \cdot \cos(30^\circ)$$



### 5) Power in Single-Phase AC Circuits using Voltage

$$\text{fx } P = \frac{V^2 \cdot \cos(\Phi)}{R}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235\_img.jpg\)](#)

$$\text{ex } 243.9305\text{W} = \frac{(130\text{V})^2 \cdot \cos(30^\circ)}{60\Omega}$$

### 6) Power in Three-Phase AC Circuits using Phase Current

$$\text{fx } P = 3 \cdot V_{\text{ph}} \cdot I_{\text{ph}} \cdot \cos(\Phi)$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0\_img.jpg\)](#)

$$\text{ex } 249.4153\text{W} = 3 \cdot 240\text{V} \cdot 0.4\text{A} \cdot \cos(30^\circ)$$

### 7) Reactive Power

$$\text{fx } Q = I \cdot V \cdot \sin(\Phi)$$

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f\_img.jpg\)](#)

$$\text{ex } 136.5\text{VAR} = 2.1\text{A} \cdot 130\text{V} \cdot \sin(30^\circ)$$

### 8) Reactive Power using Line-to-Neutral Current

$$\text{fx } Q = 3 \cdot I_{\text{ln}} \cdot V_{\text{ln}} \cdot \sin(\Phi)$$

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754\_img.jpg\)](#)

$$\text{ex } 134.355\text{VAR} = 3 \cdot 1.3\text{A} \cdot 68.9\text{V} \cdot \sin(30^\circ)$$

### 9) Reactive Power using RMS Voltage and Current

$$\text{fx } Q = V_{\text{rms}} \cdot I_{\text{rms}} \cdot \sin(\Phi)$$

[Open Calculator !\[\]\(aff7c69c44a5e015f18c35867ef3f5c3\_img.jpg\)](#)

$$\text{ex } 135.125\text{VAR} = 57.5\text{V} \cdot 4.7\text{A} \cdot \sin(30^\circ)$$



## 10) Real Power in AC Circuit

$$fx \quad P = V \cdot I \cdot \cos(\Phi)$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95\_img.jpg\)](#)

$$ex \quad 236.4249W = 130V \cdot 2.1A \cdot \cos(30^\circ)$$

## 11) Real Power using Line-to-Neutral Voltage

$$fx \quad P = 3 \cdot I_{ln} \cdot V_{ln} \cdot \cos(\Phi)$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2\_img.jpg\)](#)

$$ex \quad 232.7097W = 3 \cdot 1.3A \cdot 68.9V \cdot \cos(30^\circ)$$

## 12) Real Power using RMS Voltage and Current

$$fx \quad P = I_{rms} \cdot V_{rms} \cdot \cos(\Phi)$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7\_img.jpg\)](#)

$$ex \quad 234.0434W = 4.7A \cdot 57.5V \cdot \cos(30^\circ)$$








## Variables Used

- **I** Current (Ampere)
- **I<sub>ln</sub>** Line to Neutral Current (Ampere)
- **I<sub>ph</sub>** Phase Current (Ampere)
- **I<sub>rms</sub>** Root Mean Square Current (Ampere)
- **P** Real Power (Watt)
- **Q** Reactive Power (Volt Ampere Reactive)
- **R** Resistance (Ohm)
- **S** Complex Power (Volt Ampere)
- **V** Voltage (Volt)
- **V<sub>ln</sub>** Line to Neutral Voltage (Volt)
- **V<sub>ph</sub>** Phase Voltage (Volt)
- **V<sub>rms</sub>** Root Mean Square Voltage (Volt)
- **Φ** Phase Difference (Degree)



## Constants, Functions, Measurements used

- **Function:** **cos**,  $\cos(\text{Angle})$   
*Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- **Function:** **sin**,  $\sin(\text{Angle})$   
*Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.*
- **Function:** **sqrt**,  $\text{sqrt}(\text{Number})$   
*A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- **Measurement:** **Electric Current** in Ampere (A)  
*Electric Current Unit Conversion* 
- **Measurement:** **Power** in Volt Ampere (VA), Watt (W), Volt Ampere Reactive (VAR)  
*Power Unit Conversion* 
- **Measurement:** **Angle** in Degree ( $^{\circ}$ )  
*Angle Unit Conversion* 
- **Measurement:** **Electric Resistance** in Ohm ( $\Omega$ )  
*Electric Resistance Unit Conversion* 
- **Measurement:** **Electric Potential** in Volt (V)  
*Electric Potential Unit Conversion* 



## Check other formula lists

- [AC Circuit Design Formulas](#) 
- [AC Power Formulas](#) 
- [RLC Circuit Formulas](#) 

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