EX: If $\mathbf{F} = (2.5 + j3.2)$ find $\mathbf{P}^{-1}[\mathbf{F}]$, (i.e., find the inverse phasor)

ANS: $\mathbf{P}^{-1}[\mathbf{F}] = 4.06\cos(\omega t + 52°)$

SOL'N: We convert to polar form:

$$2.5 + j3.2 = \sqrt{2.5^2 + 3.2^2}\,e^{j\tan^{-1}\left(\frac{3.2}{2.5}\right)} \approx 4.06e^{j52°}$$

Now use the standard inverse phasor identity:

$$\mathbf{P}^{-1}[Ae^{j\phi}] = A\cos(\omega t + \phi)$$

NOTE: There is no math to do here—we just substitute the values of A and ϕ into the cos( ).

NOTE: We don't know the value of ω for this problem. Thus, we just use a symbolic variable for ω. The value of ω is *not* part of a phasor. (The value of ω must be kept track of separately.)

Using the identity gives the answer:

$$\mathbf{P}^{-1}[\mathbf{F}] = 4.06\cos(\omega t + 52°)$$

NOTE: Mathematically, it is also correct to invert the given phasor in two pieces, with the real part giving a cosine term having no phase shift and the imaginary part giving a (negative) sine term having no phase shift:

$$\mathbf{P}^{-1}[2.5 + j3.2] = 2.5\cos(\omega t) - 3.2\sin(\omega t).$$

Although this answer is correct, it is usually easier to visualize a single sinusoid with a phase shift. The sum of the cos and sin terms is equal to the single cos with a phase shift given above. This follows from the observation that the sum of any number of sinusoids of the same frequency may be expressed as a single sinusoid of that frequency. (The challenging part is determining the magnitude and phase shift of the single sinusoid.)