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

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

SOL'N: We convert to polar form:

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

Now use the standard inverse phasor identity:

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

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

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

Using the identity gives the answer:

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

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:

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

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.)