Working with Complex Amplitudes Concept Test

A signal $y(t)$ is represented as

$$y(t) = \text{Real}\left[Y e^{j\omega t}\right]$$

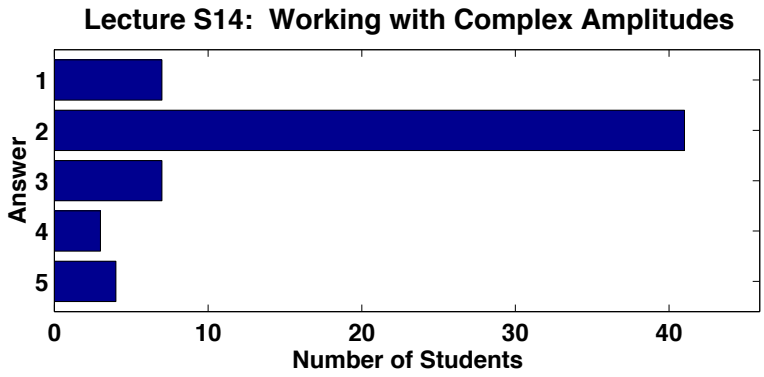
where

$$Y = Y_R + jY_I$$

Express $y(t)$ in terms of sines and cosines.

1. $y(t) = Y_R \cos \omega t + Y_I \sin \omega t$
2. $y(t) = Y_R \cos \omega t - Y_I \sin \omega t$
3. $y(t) = Y_I \cos \omega t + Y_R \sin \omega t$
4. $y(t) = Y_I \cos \omega t - Y_R \sin \omega t$
5. **None of the above**

Working with Complex Amplitudes Solution



$y(t)$ can be found by direct calculation:

$$\begin{aligned} y(t) &= \text{Real}\left[Ye^{j\omega t}\right] \\ &= \text{Real}\left[(Y_R + jY_I)\left(\cos j\omega t + j\sin j\omega t\right)\right] \\ &= \text{Real}\left[Y_R \cos j\omega t + jY_I \cos j\omega t \right. \\ &\qquad \left. + jY_R \sin j\omega t - Y_I \sin j\omega t\right] \\ &= Y_R \cos j\omega t - Y_I \sin j\omega t \end{aligned}$$

So Y_R and Y_I correspond to the amplitudes of the cosine and sine components. The tricky thing is that the amplitude of the sine part is $-Y_I$.

Most students got this right. Good!