ELEC2040 Practice Quiz

Q1   Let $z_1 = -2 - 2\sqrt{3}j$, and $z_2 = \dfrac{1}{4}\exp\left(j\dfrac{\pi}{6}\right)$ find:

    i. $|z_1|$

    ii. $\arg(z_1)$

    iii.   Write z_1 in exponential form (i.e. $r\exp(j\phi)$). Find r and ϕ.

    iv.   Find z_1^* (express in the form $x + jy$ - Cartesian form). Find x and y.

    v.   Write z_1^* in terms of r and ϕ (from part (c)).

    vi.   Find $z_1 \cdot z_1^*$

    vii.   Find z_1^{-1} in exponential form

    viii.   Find $z_1 \cdot z_2$ in Cartesian form

    ix.   Find z_2 / z_1 in exponential form

    x.   Find $\left|\exp\left(j\dfrac{\pi}{2}\right) - 1\right|$

Q2

Let $H = \sqrt{3} + j$, and let H^* be the complex conjugate of H.
Show that

$$\frac{H^*}{2}\exp(-j(\omega t + \theta)) + \frac{H}{2}\exp(j(\omega t + \theta))$$

can be written in the form

$$A\cos(\omega t + \theta + \Phi) \text{ for some real constants } A \text{ and } \Phi.$$

Find A and Φ.

Useful Trigonometric formulae

$$\sin(0) = 0 \qquad \cos(0) = 1$$

$$\sin\left(\frac{\pi}{6}\right) = \frac{1}{2} \quad \cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$$

$$\sin\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}} \quad \cos\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}$$

$$\sin\left(\frac{\pi}{3}\right) = \frac{\sqrt{3}}{2} \quad \cos\left(\frac{\pi}{3}\right) = \frac{1}{2}$$

$$\cos(\theta) = \frac{1}{2}\left(\exp(-j\theta) + \exp(j\theta)\right)$$

$$\sin(\theta) = \frac{1}{2j}\left(\exp(j\theta) - \exp(-j\theta)\right)$$

$$e^{\pm jx} = \cos x \pm j \sin x$$

$$\cos x = \sin(x + 90^{\circ}) = \frac{1}{2}(e^{jx} + e^{-jx})$$

$$\sin x = \cos(x - 90^{\circ}) = \frac{1}{2j}(e^{jx} - e^{-jx})$$

$$\cos^2 x + \sin^2 x = 1$$

$$\cos^2 x - \sin^2 x = \cos 2x$$

$$\cos^2 x = \frac{1}{2}(1 + \cos 2x)$$

$$\sin^2 x = \frac{1}{2}(1 - \cos 2x)$$

$$\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$$

$$\sin(x \pm y) = \sin x \cos y \pm \cos x \sin y$$

$$2 \cos x \cos y = \cos(x - y) + \cos(x + y)$$

$$2 \sin x \sin y = \cos(x - y) - \cos(x + y)$$

$$2 \sin x \cos y = \sin(x - y) + \sin(x + y)$$

End of test paper