

EE 3340
Homework Problem #004

If $\mathbf{a} = 1 - j$, $\mathbf{b} = 2e^{j\pi}$, $\mathbf{c} = 3 + j5$, and $\mathbf{d} = 3\angle 60^\circ$, determine

$$\mathbf{x} = \frac{\mathbf{a}^2 - \mathbf{b}^3}{\mathbf{c} \times \mathbf{d}}$$

and express your result in rectangular form.

$$\mathbf{a}^2 = (1 - j)(1 - j) = 1 - j - j + j^2 = -j^2$$

$$\begin{aligned} \mathbf{b}^3 &= (2e^{j\pi})^3 = 2^3 e^{j3\pi} = 8(\cos 3\pi + j\sin 3\pi) \\ &= 8(-1) = -8 \end{aligned}$$

$$\mathbf{a}^2 - \mathbf{b}^3 = -j^2 + 8 = \sqrt{8^2 + 2^2} \angle \tan^{-1} \frac{-2}{8} = 8.246 \angle -14.036^\circ$$

$$\mathbf{c} = 3 + j5 = \sqrt{3^2 + 5^2} \angle \tan^{-1} \frac{5}{3} = \sqrt{34} \angle 59.04^\circ$$

$$\mathbf{c} \times \mathbf{d} = (\sqrt{34} \angle 59.04^\circ)(3 \angle 60^\circ) = 3\sqrt{34} \angle 119.04^\circ$$

$$\mathbf{x} = \frac{8.246 \angle -14.036^\circ}{3\sqrt{34} \angle 119.04^\circ}$$

$$= 0.471 \angle -133.076^\circ$$

$$= 0.471 \cos(-133.076^\circ) + j 0.471 \sin(-133.076^\circ)$$

$$= -0.322 - j 0.344$$