Homework Problem #005

(a) Reduce $z = \dfrac{2+j3}{4+j5}$ to simple rectangular form.

$$z = \frac{2+j3}{4+j5} \cdot \frac{4-j5}{4-j5} = \frac{8+j12-j10+15}{16+25} = \frac{23+j2}{41}$$

$$= \frac{23}{41} + j\frac{2}{41} \quad \text{or} \quad 0.561 + j0.049$$

(b) Convert $z = 6.4 - j5.6$ to polar form, with the angle in degrees.

$$z = 6.4 - j5.6 = \sqrt{(6.4)^2 + (5.6)^2} \; \left\lfloor \tan^{-1} \frac{-5.6}{6.4} \right.$$

$$\approx \sqrt{72.32} \; \lfloor -41.19° \approx 8.50 \; \lfloor -41.19°$$

(c) Given $x = 3.1e^{j1.8}$ and $y = -3.6 + j2.9$, determine $z = \dfrac{x}{y}$ and express the result in exponential form with the angle in radians.

$$y = -3.6 + j2.9 = \sqrt{(3.6)^2 + (2.9)^2} \; \left\lfloor \tan^{-1} \frac{2.9}{-3.6} \right.$$

$$\approx \sqrt{21.37} \; \lfloor 2.46 \text{ rad} \approx 4.62 \; \lfloor 2.46 \text{ rad}$$

$$\approx 4.62 \, e^{j2.46}$$

$$z = \frac{3.1 e^{j1.8}}{4.62 e^{j2.46}} = \frac{3.1}{4.62} e^{j(1.8-2.46)}$$

$$\approx 0.671 \, e^{-j0.66}$$