

1.16 Complex numbers z_1 and z_2 are given by

$$z_1 = 3 - j2$$

$$z_2 = -4 + j3$$

- (a) Express z_1 and z_2 in polar form.
- (b) Find $|z_1|$ by first applying Eq. (1.41) and then by applying Eq. (1.43).
- (c) Determine the product $z_1 z_2$ in polar form.
- (d) Determine the ratio z_1/z_2 in polar form.
- (e) Determine z_1^3 in polar form.

Solution:

- (a) Using Eq. (1.41),

$$z_1 = 3 - j2 = 3.6 \exp -j33.7^\circ,$$

$$z_2 = -4 + j3 = 5 \exp j143.1^\circ.$$

- (b) By Eq. (1.41) and Eq. (1.43), respectively,

$$|z_1| = |3 - j2| = \sqrt{3^2 + (-2)^2} = \sqrt{13} = 3.60,$$

$$|z_1| = \sqrt{(3 - j2)(3 + j2)} = \sqrt{13} = 3.60.$$

- (c) By applying Eq. (1.47b) to the results of part (a),

$$z_1 z_2 = 3.6 \exp -j33.7^\circ \times 5 \exp j143.1^\circ = 18 \exp j109.4^\circ.$$

- (d) By applying Eq. (1.48b) to the results of part (a),

$$\frac{z_1}{z_2} = \frac{3.6 \exp -j33.7^\circ}{5 \exp j143.1^\circ} = 0.72 \exp -j176.8^\circ.$$

- (e) By applying Eq. (1.49) to the results of part (a),

$$z_1^3 = (3.6 \exp -j33.7^\circ)^3 = (3.6)^3 \exp -j3 \times 33.7^\circ = 46.66 \exp -j101.1^\circ.$$
