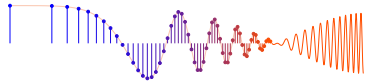


PROBLEM:

Convert the following to polar form:

(a) $z = j10$ (b) $z = -10$ (c) $z = (-10, -10)$

(d) $z = -2 + j2$ (e) $z = -3 + j\sqrt{3}$ (f) $z = 20$

Give numerical values for the magnitude, and the angle (or phase) in radians.

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

(a) $z = j10$ $\quad z = Ae^{j\theta}$ $\quad A = \sqrt{0^2+10^2} = 10$

$z = 0+j10$ $\quad \theta = \tan^{-1}\left[\frac{Im(z)}{Re(z)}\right] = \tan^{-1}\left(\frac{10}{0}\right) = \frac{\pi}{2}$

$z = 10e^{j\pi/2}$

(b) $z = -10 = -10+j0 = 10e^{j\pi}$

(c) $z = (-10, -10)$ (an ordered pair)

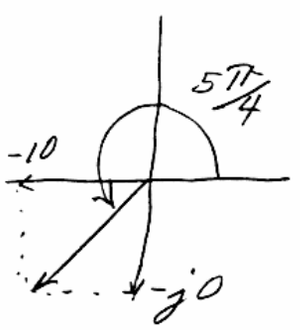
$z = -10 - j10$

$z = Ae^{j\theta}$ $\quad A = \sqrt{10^2+10^2} = 10\sqrt{2}$

$\theta = \tan^{-1}\frac{10}{10} = \frac{\pi}{4}$ <u>BUT</u> this is the principal.

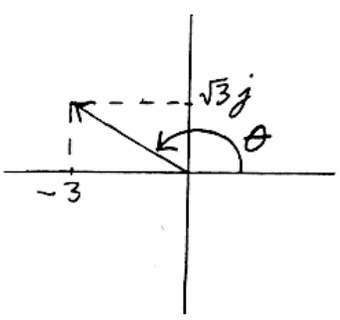
The actual value $= \frac{\pi}{4} + \pi = \frac{5\pi}{4}$

$z = 10\sqrt{2}\,e^{j\frac{5\pi}{4}}$



(d) $z = -2+j2 = 2\sqrt{2}\,e^{j\frac{3\pi}{4}}$

(e) $z = -3+j\sqrt{3}$ $\quad A = \sqrt{3^2+\sqrt{3}^2} = \sqrt{12} = 2\sqrt{3}$



$\tan^{-1}\frac{\sqrt{3}}{-3} = -0.52 \text{ rad.} = -\frac{\pi}{6}$

Obviously $\theta = -\pi/6 + \pi = \frac{5\pi}{6}$

$z = 2\sqrt{3}\,e^{j\frac{5\pi}{6}}$

(f) $z = 20 = 20e^{j0}$