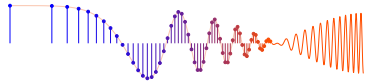

## PROBLEM:

Simplify the following complex-valued expressions. Give your answer in either rectangular or polar form, whichever is most convenient. In parts (a)-(d) assume that $A$, $\alpha$, and $\phi$ are positive real numbers. Your answers to parts (a)-(d) will be in terms of these quantities.

(a) For $z = Ae^{-j\pi/3}$, determine a simple expression for $\Im m\{z^*\}$.

(b) For $z = Ae^{-j\pi/3}$, determine a simple expression for $z + z^*$.

(c) For $z = 10e^{j\phi}$, determine a simple expression for $\Re e\{jz\}$.

(d) For $z = -\alpha + j\alpha$, determine a simple expression for $z$ in polar form.

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

SOLUTION

a) $z = A e^{-j\frac{\pi}{3}}$

$z^* = A e^{+j\frac{\pi}{3}}$

$Im(z^*) = A \sin\left(\frac{\pi}{3}\right) = A\frac{\sqrt{3}}{2}$

b) $z = A e^{-j\frac{\pi}{3}}$ NOTE: $z + z^* = 2Re(z)$

$z + z^* = 2A\cos\left(\frac{\pi}{3}\right) = A$

c) $z = 10 e^{j\phi}$

$jz = 10 e^{j(\phi + \frac{\pi}{2})}$

$Re(jz) = 10\cos\left(\phi + \frac{\pi}{2}\right)$

$= -10\sin(\phi)$ NOTE: $-\sin(\theta) = \cos\left(\phi + \frac{\pi}{2}\right)$

d) $z = -\alpha + j\alpha$

$= \alpha(-1 + j)$

$= \sqrt{2}\alpha\, e^{j\frac{3}{4}\pi}$