Problem 1
Evaluate the following expressions for the complex number $z = \frac{3}{4} e^{\frac{\pi}{4} j}$.
(a) $\text{Re}\{z\}$, the real part of $z$
(b) $\text{Im}\{z\}$, the imaginary part of $z$
(c) $|z|$, the magnitude of $z$
(d) $\angle z$ (or $\text{arg}(z)$), the angle of $z$
(e) $z^*$, the complex conjugate of $z$
(f) $z + z^*$

Problem 2
Let $z$ be an arbitrary complex number ($z = \alpha + j\omega$)
(a) Show that $\text{Re}\{z\} = \frac{z + z^*}{2}$
(b) Show that $j\text{Im}\{z\} = \frac{z - z^*}{2}$

Problem 3
Using Euler's Formula ($e^{j\theta} = \cos\theta + j\sin\theta$), show that
(a) $\cos\theta = \frac{e^{j\theta} + e^{-j\theta}}{2}$ and (b) $\sin\theta = \frac{e^{j\theta} - e^{-j\theta}}{2j}$

Problem 4
Express the following expressions in polar form. In other words, given that $z = e^{j\theta}$, find the magnitude and angle for the following.
(a) $z^*$
(b) $z^2$
(c) $jz$
(d) $zz^*$
(e) $\frac{z}{z^*}$
(f) $\frac{1}{z}$
Problem 5

Given that \( z = \frac{2}{3} e^{\frac{j\pi}{6}} \) (\( z = r e^{j\theta} \) with \( r = \frac{2}{3} \) \& \( \theta = \frac{\pi}{6} \)), plot the vectors in the complex plane described by the following expressions.

(a) \( z^* \)  
(b) \( z^2 \)  
(c) \( jz \)  
(d) \( zz^* \)  
(e) \( \frac{z}{z^*} \)  
(f) \( \frac{1}{z} \)

Problem 6

Given \( x(t) \) shown in the figure, sketch the following expressions:

(a) \( x(-t) \)  
(b) \( x(t+2) \)  
(c) \( x(2t+2) \)  
(d) \( x(1-3t) \)

Problem 7

Find the even and odd parts of the following

(a) \( x(t) = e^t \)  
(b) \( x(t) = e^{-t} \)  
(c) \( x(t) = \begin{cases} 0 & t < 0 \\ \cos(t) & t \geq 0 \end{cases} \)  
(d) \( x(t) = \begin{cases} 0 & t < 0 \\ \sin(t) & t \geq 0 \end{cases} \)