## **PROBLEM**: Simplify the following complex-valued expressions. Reduce the answers to a simple numerical form. (a) For $W = -3 + j\sqrt{3}$ , express the conjugate $W^*$ in polar form. In addition, plot $W^*$ as a vector. (b) For U = -1 + j, express the inverse $U^{-1}$ in rectangular form. In addition, plot $U^{-1}$ as a vector. (c) For $Z = j(1-j)^3$ , express Z in polar form. In addition, plot Z as a vector.

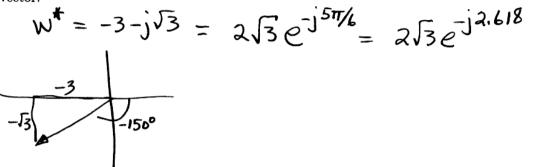
(d) For  $V = 3je^{-j\pi/3}$ , express  $\Re \{Ve^{j7\pi t}\}$  as a sinusoid in the standard "cosine" form.

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(a) For  $W = -3 + j\sqrt{3}$ , express the conjugate  $W^*$  in polar form. In addition, plot  $W^*$  as a vector.



(b) For U = -1 + j, express the inverse  $U^{-1}$  in rectangular form. In addition, plot  $U^{-1}$  as a vector.

$$U' = \frac{1}{U} = \frac{U^{*}}{|U|^{2}} = \frac{-1-j}{|^{2}+|^{2}} = -\frac{j}{2} - \frac{j}{2}$$

$$= \sqrt{2} e^{-j\frac{3\pi}{4}} = \sqrt{2} e^{-j2.356}$$

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(c) For  $Z = j(1-j)^3$ , express Z in polar form. In addition, plot Z as a vector.

$$1-j = \sqrt{2} e^{j\pi/4} \quad (1-j)^3 = 2\sqrt{2} e^{j^3\pi/4} \qquad 2^{-45^{\circ}}$$

$$Z = (e^{j\pi/2})(2\sqrt{2} e^{-j^3\pi/4}) \qquad 2^{-45^{\circ}}$$

$$= 2\sqrt{2} e^{j\pi/4} = 2\sqrt{2} e^{-j^{\circ}.785}$$

$$= 2-j^2$$

(d) For  $V = 3je^{-j\pi/3}$ , express  $\Re\{Ve^{j7\pi t}\}$  as a sinusoid in the standard "cosine" form.

$$V = 3e^{j\frac{\pi}{2}}e^{-j\frac{\pi}{3}} = 3e^{j\frac{\pi}{6}}$$
  
Ref 3e^{j\frac{\pi}{6}}e^{j\frac{\pi}{7}}f = 3\cos(7\pi t + \frac{\pi}{6}).

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