Complex Numbers Homework (#6)
C. DiMarzio, Northeastern University
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1. Calculate the sum $(4 + 3j) + (3 + 4j)$. Convert to polar form.

2a. Calculate the product, $(4 + 3j)(3 + 4j)$. Do this in rectangular form.

2b. Convert both numbers to polar form and compute the product. Do your answers agree?

Write the following in rectangular form.

3. $10\sqrt{2}\angle\pi/6$.
4. $e^{3+j\pi/4}$.
5. j^{282}.
6. j^{2016}.

Write the following in polar form.

7. $\sqrt{j}$.
8. $13\,\text{Ohms} + j20\,\text{Ohms}$.
9. $(3 + 2j)\,e^{j\pi/2}$.
10. $j(3 + 2j)$.

Compute the complex conjugate in the same form as the given expression.

11. $7\angle\pi/3$
12. $4 + 3j$
13. $36e^{j\pi/4}$

14a. Write the voltage as a function of time for the complex representation $15\,\text{V}e^{pi/4}$ at $f = 440\,\text{Hz}$.

14b. Write the complex representation of $V = 20\,\text{V}\cos\omega t + 22\,\text{degrees}$. This is kind of a trick question. Remember the exponential notation uses radians.

15. Your goal is to digitize the elevation measured by an altimeter you

are carrying on a hike. Assume that you are in really great shape and can tackle any mountain on Earth (The highest mountain is 8849 meters). You want to collect the data with a step size of 2 meters.

    a. How many bits do you need in your digital–to–analog converter?

    b. Suppose that the device produces a voltage of zero at sea level and 1 volt at an elevation of 10 km. Your converter expects an input of -5 to 5 Volts. What circuit do you need between your altimeter and your converter? There is more than one right answer.

    c. Assuming that the signal is noise-free, what is the maximum error in your data?