# Review problems: complex numbers and sinusoids

**THIS IS NOT AN ASSIGNMENT**. However, working with complex sinusoids is **very** important for DSP. Of course you have seen this material before, but you may be rusty, so reviewing it would be a good idea. If you aren't sure how to work these problems, talk to me or a TA.

The following videos are helpful:

https://youtu.be/UAn9uah7puU

https://youtu.be/GhhRIjMywu0

1) For each of the following numbers, write down its magnitude and phase, and plot it on the complex plane
    a. x1 = 2 +2j
    b. x2 = 1.5 exp(-j pi/4)
    c. x2 * x3, if x3 = 2 exp(j 3 pi/ 4) and x2 is in part b
    d. 3j

2) If x = a + jb, prove (working in rectangular / Cartesian coordinates) that x x* = |x|^2

3) Use Euler's formula to show why calculating the angle of a complex number involves using a tangent function.

4) Write the sinusoid y(n) = 16 * cos( 120 n + pi / 3) as a sum of two complex sinusoids

5) Write down the number 125 in polar coordinates. Then, write down a formula for an infinite number of ways to write the number 125 (hint: what happens if you rotate by 2 pi in the complex plane?)

These two are not in the video:

6) Prove that 20*log10( |x| ) = 10*log10( |x|^2 ) (not in video)

7) If you have a complex-valued number z in Matlab, write the commands to find

    a. The real part of z
    b. The magnitude – squared of z
    c. The phase of z
    d. The phase of z in degrees