Math 345 Complex Variables Fall 2017 Prof. Janeba

Study questions for Complex Variables - Day 1 - Please prepare in advance of the first day of class

- Read sections (not chapters) 1-3 of our textbook somewhat carefully. That's pages 1-7. Remember the first sections are available on the class WISE site for those who don't have the text yet.
- Think about these questions, and jot down some notes, so that you are prepared to discuss on the first day of class:

1. What could be the purpose of going through all these algebra rules we see in sections 1-3? Didn't we already know them? Try to answer in some depth, by anticipating reasonable follow-up questions - i.e. the natural questions to ask following your initial answer.
2. This may help spark some follow-up questions in #1: Consider the dialog below.
   - Lucy: Every blockhead knows about commutativity (that $z + w = w + z$ and $zw = wz$), we learned that in middle school. We don't need to review algebra, let's get on to the new stuff.
   - Linus: Ok, so help me with this: We all know that the square root of 1 is 1, and the square root of -1 is i, from high school algebra. So then

     $$1 = \sqrt{1} = \sqrt{(-1)(-1)} = \sqrt{-1} \cdot \sqrt{-1} = i \cdot i = -1.$$

     So $1 = -1$. Adding 1 to both sides gives $2 = 0$, and dividing by 2 gives $1 = 0$.
     Adding 1 to both sides of that gives $2 = 1$, so then $2 = 1 = 0$. Repeating, we get $3 = 2$, so...

   What is the significance of this dialog? [If you have a quick resolution, be sure to give it, and test it to make sure it really solves the problem.] How does this pertain to question #1?
3. [This one is hard] What is the point of the ordered-pair notation that starts immediately on page 1? Why not just use i as the square root of -1 and go from there?
   P.S.: Glance again through the reading: how much does the ordered pair notation get used in section 1? In section 2? In section 3? (Go ahead and peek further ahead if you like). Is there a trend? What? What could it mean?
4. Think for a bit and briefly summarize all you already know about complex numbers (you might start with finding complex roots of quadratics, e.g. $x^2 + 2x + 2 = 0$, via the quadratic formula, which you probably saw in high school algebra). For most students, it may not go much farther. Where do you suppose our study will go? (Have you heard hints in other classes?) Note that the typical math education progressively introduces students to new number systems: natural, or counting numbers; rationsl numbers or fractions; negative numbers; real numbers, particularly irrational numbers; now complex numbers. Do you suppose the complex numbers are just another step of many steps that enlarge our perspective or might this step stand out from the others - and how is that even possible? What sorts of things could make one step in this progression somehow of a distinct character than the others - what could that even mean?