Project Proposal: Gaussian Prime Cycles

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Firstly, we need to define that Gaussian integers are complex numbers of the form $a + bi$, where a and b are integers. Some Gaussian integers have no nontrivial factorization. These can be considered similar to the primes of the natural numbers and are called Gaussian primes. Since we are considering complex integers, we will be operating within the framework of the 2D plane restricted to integers, so when we say step right that could be thought to mean to move from the point (x, y) to $(x + 1, y)$ or $a + bi$ to $a + 1 + bi$.

We will investigate Gaussian prime cycles. The cycles are formed by starting at a given point and stepping right until a Gaussian prime is found, at which point the direction becomes down. The process of stepping in the same direction until a Gaussian prime is found, then rotating the direction 90 degrees is repeated until we return to the initial point and initial direction. For the project, we will plot the cycle length as a function of the initial point and the discrete derivative/finite difference of the function. The question we hope to answer is whether there is a discernable pattern to the aforementioned plots. The project will approach the problem using two implementations: numeric, using standard Python, and symbolic, using the Python library sympy.