Class Prep (prepare for Friday, February 9)

Read the Geometric Constructions section from *Contemporary Abstract Algebra* that you got at the end of class Wednesday. Here's a definition you'll need and some quick examples (and we'll talk about some of the other new terms in class/in a future reading):

Definition 1. *A* field *is a set F together with two binary operations $+$ and $\cdot$ such that for all $a, b, c \in F$,*

- $a + b \in F$ *and* $a \cdot b \in F$ *(closure)*
- $a + b = b + a$ *and* $a \cdot b = b \cdot a$ *(commutativity)*
- *there is a* $0 \in F$ *such that* $a + 0 = a$ *(additive identity)*
- *there is a* $1 \in F$ *such that* $a \cdot 1 = a$ *(multiplicative identity)*
- *there is an element* $-a \in F$ *such that* $a + (-a) = 0$ *(additive inverse)*
- *there is an element* $a^{-1} \in F$ *such that* $a \cdot a^{-1} = 1$ *(multiplicative inverse)*
- $a \cdot (b + c) = a \cdot b + a \cdot c$ *(distributivity)*

Example 1. The real numbers form a field, as do the rationals and the complex numbers (do you see why?). The integers do *not* form a field—why?

Problems (due Friday, February 16 at the beginning of class)

1. Write out the details showing that the method we used in class does divide a square piece of paper into thirds. Then explain how we can generalize to dividing a square piece of paper into any $n$ths we so desire (theoretically; we aren't realistically going to be folding many of these well). Don't neglect the even ns in your explanation. ☺

Friday's Celebration of Learning

For Friday's celebration of learning, you should be able to

- explain how knotting a strip of paper into a regular polygon is related to $(\mathbb{Z}_n, +)$, including
  - for which values of n we can make a regular polygon by knotting a single strip and why (or why we can't for a particular n)
  - a way to plan your knotting so that it would work if you had the knotting skills (no judgment there!)
  - how we can use multiple strips of paper and cosets of a subgroup to also create polygonal knots
- explain how we can use origami to fold a parabola and how we know it's a parabola (not the details of finding the equation; just the idea of how the folding method relates to the definition of a parabola)
- explain how to trisect an angle with origami