September-09-09
8:34 PM

0. Math 240 Algebra I, DROR BAR-NATAN.

1. What we'll do:

The practical side:

1. Solve $5x_1 - 2x_2 + x_3 = 9$
   (how? what? one/many?) $-x_1 + x_2 - x_3 = -2$
   $2x_1 + 9x_2 - 3x_3 = -4$
   this describes the small-scale behaviour of almost everything that has a mathematical description!

2. $\hookrightarrow \begin{pmatrix} 5 & -2 & 1 \\ -1 & 1 & -1 \\ 2 & 9 & -3 \end{pmatrix} = A$ "matrices" can add, multiply, take powers: A^{2009}
   This describes the approximate long term behaviour of almost everything...

The theory side:

3. Do all of this in a coordinate-free way!
4. Do all this over "other sets of numbers".
5. Hidden agenda: Learn the basic pure-math processes of abstraction, generalization, definitions, theorems, proofs, notation, logic.

2. Go over the "About" handout.

3. The real numbers: a set $\mathbb{R}$ with two binary ops $+$ & $\times$ and two special elements 0 & 1 s.t.

done line

R1 $a+b=b+a$ $ab=ba$

R2 Assoc.

R3 0, 1

R4 negatives & inverses

R5 Distributivity.

Much of algebra, though not all, follows:

Follows: $(a+b)(a-b)=a^2-b^2$

Doesn't follow: $\forall a\ \exists x$ s.t. $a=x^2$ or $a=-x^2$

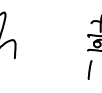
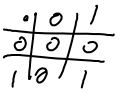
Or $\wedge$ Finl F

Def A Field F

Examples 1. The reals $\mathbb{R}$.

2. The rationals $\mathbb{Q}$

3. The complex numbers $\mathbb{C} = \{a + b\sqrt{-1}\}$

4. 0, 1 with  

5. 0, 1, 2, 3, 4, 5, 6 with a funny def. of $+, \times$.