DAY 6:  @1 25 mins
Study §1: pg 19 1-33 all
THW2 will be posted

Complex Numbers, \( \mathbb{C} = \{ a + bi \mid a, b \in \mathbb{R} \} \)
Typical element: Let \( z \in \mathbb{C} \) then
\( z = a + bi \) for some \( a, b \in \mathbb{R} \), where \( i^2 = -1 \)

\[
(a, b) \quad \quad |z| = r = \sqrt{a^2 + b^2}
\]

\[
\cos \theta = \frac{a}{r} \quad \text{so} \quad a = r \cos \theta
\]

\[
\sin \theta = \frac{b}{r} \quad \text{so} \quad b = r \sin \theta
\]

So \( z = a + bi = r \cos \theta + (r \sin \theta) i \)

\[
= r (\cos \theta + i \sin \theta)
\]

\[
= |z| e^{i \theta}
\]

\( \text{notation} \)

Look at complex mult:
let \( z_1 = a + bi \), \( z_2 = c + di \in \mathbb{C} \)
Then \( z_1 z_2 = (a + bi)(c + di) \)
\[
= ac + adi + bci + bd (i^2)
\]
\[
= (ac - bd) + (ad + bc)i
\]
or \( z_1 = |z_1| e^{i\theta_1} \) and \( z_2 = |z_2| e^{i\theta_2} \)

then \( z_1 z_2 = |z_1| |z_2| e^{i(\theta_1 + \theta_2)} \)

\[ = |z_1 z_2| e^{i(\theta_1 + \theta_2)} \]

\[ \Rightarrow \text{ cute.} \]

\( \langle \mathbb{C}, + \rangle \) is a group; \( \langle \mathbb{R}, + \rangle \) is a group
\( \langle \mathbb{C}^*, \cdot \rangle \) is a group
\( \langle \mathbb{R}^*, \cdot \rangle \) is a group

Look at \( +_n \) in \( \mathbb{R}_{2\pi} \)