· binary operation:

· associative

· nxn inventible matrices

- · has identity
- · (nonzero real numbers, .)

. inverse

· (R, +)

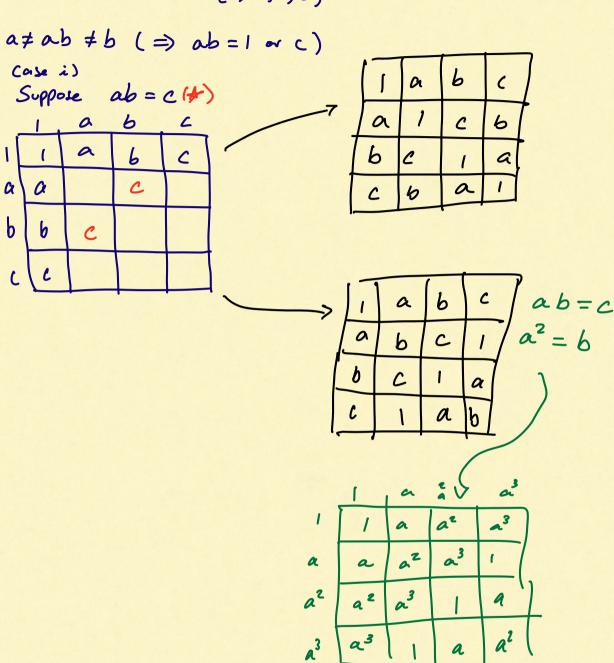
Groups w/ few elements

•
$$161 \leftarrow size af group = 1$$
means $G = {13}$

•
$$161 = 2$$
, means $G = \{1,9\}$

•
$$|G| = 3$$
, $G = \{1, \alpha, b\}$
all elts. of $|G| = \{1, \alpha, b\}$
Gove power a a a i
of a. a $|G| = \{1, \alpha, b\}$

	1	a	6	Note: ab = 16 = 6
	1			⇒ab=1
a	a	Ь	1	no choice nene
6	Ь	ı	a	



case I) ab = 1

	1	a	Ь	C	
1		a	Ь	6	
a	a	C	(Ь	
6	b	1	C	a	
C	C	Ь	a	1	

$$a = a$$

$$b = a^3$$

$$c = a^2$$

161 = 4 has 2 cases

KV4 or cyclic group of order 4.

Non example: KV4 is not cyclic

Defn: if the Cayley table of G is symmetric then
G is abelian.

(weems: ab = ba for all $a,b \in \mathcal{F}$ this will always happen if $G = \mathbb{Z}/n\mathbb{Z}$ or in $(\mathbb{R} | \{0\}, .)$

Not abelian: Sym (D)

· (nxn ; nvertibles, .)

Def": The order of G is the # of elts

Defu: the order of geG, that is the min { K & N s.t

If $g^{k} \neq 1$ for all k > 0 g = 13 $k \neq 1$ $k \neq$

we say order G (y) = 00

Ex: If |G|=1 $\Rightarrow G=\{i\}, \text{ and } (i)=1$

• |G| = 2 , $G = \{1, a\}$ $ard_G(g) = 2$

· 161 = 3 => ord(b) = 3 = ord(a)

• |6| = 4ord(a^3) = 4 = ord(a)ord(a^2) = 2kVy ord(a)

11

ord(b)

ord(b)

11

ord(b)

An example of a group where all non-identity elements have ∞ order io $(\mathbb{Z}, +)$