

Source: [\[KBe2020math530index\]](#)

1 | Groups

- definition
 - closed
 - if $a, b \in S$ then $a + b \in S$
 - has an identity e
 - $e + a = a + e = a$
 - each element has an inverse
 - $-a + a = a + -a = e$
 - needs to be associative
 - $(a + b) + c = a + (b + c)$
- commutativity is nice but not required
 - $a + b = b + a$
- Which number systems are groups under addition and multiplication?

| Number System | Multiplication | Addition |
|-----------------|----------------|-------------|
| Natural Numbers | No inverse | No identity |
| Whole Numbers | No inverse | No inverse |
| Integers | No inverse | Yes |
| Rationals | Yes* | Yes |
| Reals | Yes* | Yes |
| Complex Numbers | Yes* | Yes |

Zero doesn't have an inverse, so it usually gets dropped. For example, \mathbb{Q}^ is \mathbb{Q} w/o zero #todo-exr0n: rewrite in latex say \mathbb{Q}^*

- SRC20200825135700.png

$$\begin{bmatrix} 8 & 2 \\ -2 & 0 \end{bmatrix}$$