# Assignment - 01

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25.09.25

A set $G$ with a binary operation '+' is a group if:

1. <u>Closure</u>: $a+b \in G$ for all $a, b \in G$.

2. <u>Associativity</u>: $(a+b)+c = a+(b+c)$.

3. <u>Identity element</u>: There exists $e \in G$ such that $a+e = e+a = a$.

4. <u>Inverse element</u>: for every $a \in G$, there exists $b \in G$ such that $a+b = e$.

If in addition,

5. <u>Commutativity</u>: $a+b = b+a$, then it is an abelian Group.

Test for odd numbers,

Let, $O = -3, -1, 1, 3, 5, \ldots$

1. Closure: example: $3+5=8 \notin O$. So, not closed.

2. Associativity: Addition of odd integer is associative.

3. Identity: Identity for addition is 0. But 0 is not odd. No, ~~identy~~ identity element in $O$.

4. Inverse: Each odd $a$ would need an inverse $b$ such that $a+b=0$. Example: $3+(-3)=0$. But 0 is not in $O$.

5. Commutativity: Addition of integers is commutative.

Since, closure fails, identity is missing and hence inverse doesn't exist. So, the set of odd numbers under addition is not an abelian Group.