Definition of Monoid

A monoid is a triple $(A, \otimes, \overline{1})$

1. $\otimes$ **is closed associative binary operator on the set A**

2. $\overline{1}$ **is identity element for** $\oplus$

$\forall \quad a, b, c \in A$

$a \otimes b \otimes c = a \otimes (b \otimes c)$

$a \otimes \overline{1} = \overline{1} \otimes a = a$

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Definition of Ring

Let a, b, c $\in \mathbb{R}$

There are addition and multiplication operations and satisfy associative and distributive laws

$a * b * c = a * (b * c) \ and \ a * (b + c) = a * b + a * c$

There are additive identity **0** and multiplicative identity **1**

$\mathbf{0} + a = a$ and $1 * a = a$

There exists additive inverse $-a$ such that $a + (-a) = 0$

Definition of Ring

let a, b, c $\in \mathbb{R}$

There are two binary operations addition and multiplication and satisfy

Associative Law

$a \times b \times c = a \times (b \times c)$

Distritutive Law

$a \times (b + c) = a \times b + a \times c$

Additive inverse

For all a in $\mathbb{R}$, there exists -a such that

$a + (-a) = 0$

Multiplicative identity

For all a in $\mathbb{R}$, there exist 1 such that

$1a = a$

Group homomorphism(operation preserving)

Given group $(G1, +)$ and $(G2, *)$,for all $a_1, a_2 \in G1$ and $b_1, b_2 \in G2$, if $\phi(a_1 + a_2) = \phi(b_1) * \phi(b_2)$, then ϕ is group homomorphism

Given $G(\mathbb{R}, +)$ and $(\mathbb{R}, *)$, then $\phi(x) = e^x$ is homomorphism

Let $a_1, b_1 \in \mathbb{R}$ and $a_2, b_2 \in \mathbb{R}$

$\phi(a_1 + b_1) = e^{a_1 + b_1}$ and $\phi(a_2) * \phi(b_2) = e^{a_2} * e^{b_2} = e^{a_2 + b_2}$

$\Rightarrow \phi(a_1 + b_1) = \phi(a_2) * \phi(b_2)$