

$$0 = 1 - 1 = -1 + 1 = 0$$

# From Elementary School to Higher Algebras

Keyao Peng

IMB

March 24, 2024

## Your favorite equations?

---

- $a^2 + b^2 = c^2$
- $e^{i\pi} + 1 = 0$
- $\int_{\partial D} \omega = \int_D d\omega$
- ...

## Your favorite equations?

---

- $a^2 + b^2 = c^2$
- $e^{i\pi} + 1 = 0$
- $\int_{\partial D} \omega = \int_D d\omega$
- ...

But, what is an **equation** ?

## Your favorite equations?

---

- $a^2 + b^2 = c^2$
- $e^{i\pi} + 1 = 0$
- $\int_{\partial D} \omega = \int_D d\omega$
- ...

But, what is an **equation** ?

$A = B$  says  $A$  **is** equal to  $B$ , **how** they are equal depends on the *proof*.

## Your favorite equations?

---

- $a^2 + b^2 = c^2$
- $e^{i\pi} + 1 = 0$
- $\int_{\partial D} \omega = \int_D d\omega$
- ...

But, what is an **equation** ?

$A = B$  says  $A$  **is** equal to  $B$ , **how** they are equal depends on the *proof*.

### Question

Can you prove  $0 = 0$ , non-trivially?

## Test your math level

---

# Test your math level

$$S^3 \sim \mathbb{C}^2 \setminus \{0\} \rightarrow \mathbb{CP}^1 \sim S^2$$



$$\pi_4(S^3) \cong \mathbb{Z}/2\mathbb{Z}$$

$$\pi_1^s(S) \cong \Omega_1^{\text{fr}}$$

$$K_1(\mathbb{F}_1) \cong S_\infty^{\text{ab}}$$

$$0=1-1=1+1=0$$

imgflip.com



