

## Advent of Mathematical Symbols

Quaternions:  $\mathbb{H} \supseteq \mathbb{C}$  (William Rowan Hamilton)  
 $a, b, c, d \in \mathbb{R}$

↶ multiplication is not commutative

$$a + i \cdot b + j \cdot c + k \cdot d, \quad i^2 = -1, \quad j^2 = -1, \quad k^2 = -1, \quad ijk = -1$$

$$\Rightarrow i \cdot j = -j \cdot i$$