

Find at least two automorphisms of the quaternions \mathbb{H} . That is, find two different maps $\Phi : \mathbb{H} \longrightarrow \mathbb{H}$ such that in each case

$$\Phi(pq) = \Phi(p)\Phi(q).$$

HINT: It is enough to consider maps that take each of the four basis directions $1, i, j, k$ to another such direction (possibly with the opposite orientation).