④ Right hand

$(a,b) * [(c,d) * (e,f)] =$

$(a,b) * (c+e, d+f+2df) =$

$(a+c+e,\ b+d+f+2df+2bd+2bf+4dbf)$ ---②

$\therefore ① = ②$

$*$ is assoc.

---

⑤ $a * b = b \quad \forall\ a,b \in (Z, *)$

sol. : let $a,b,c \in Z$

$(a*b)*c \overset{?}{=} a*(b*c)$

$b*c \overset{?}{=} a*c$

$c = c$

$\therefore *$ is asso.