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If $[XY] := XY - YX$, for any X, Y, Z in V and any α, β in K,

1) then $[\alpha X + \beta Y, Z]$

$$= (\alpha X + \beta Y)Z - Z(\alpha X + \beta Y)$$

$$= \alpha(XZ - ZX) + \beta(YZ - ZY)$$

$$= \alpha[X, Z] + \beta[Y, Z]$$

$$[\alpha X + \beta Y, Z] = \alpha[X, Z] + \beta[Y, Z]$$

2) $[X, Y]$

$$= XY - YX$$

$$= -(YX - XY)$$

$$= -[Y, X]$$

$$[X, Y] = -[Y, X]$$

3) $[X, [Y, Z]] + [Y, [Z, X]] + [Z, [X, Y]]$

$$= [X, YZ - ZY] + [Y, ZX - XZ] + [Z, XY - YX]$$

$$= X(YZ - ZY) - (YZ - ZY)X + Y(ZX - XZ) - (ZX - XZ)Y$$

$$+ Z(XY - YX) - (XY - YX)Z$$
$$= 0$$

$$[X, [Y, Z]] + [Y, [Z, X]] + [Z, [X, Y]] = 0$$