$$
\begin{aligned}
cu + du &= c(x, y) + d(x', y') \\
&= (cx, cy) \oplus (dx', dy') \\
&= (cx + dx' + 1, cy + dy' + 1)
\end{aligned}
$$

$$(c+d)u \neq cu + du$$

Q The set of all 2x2 matrices of the form $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$ with matrix addition and multiplication.

Solution

Let, $u = \begin{bmatrix} a_1 & 0 \\ 0 & b_1 \end{bmatrix}$ $v = \begin{bmatrix} a_2 & 0 \\ 0 & b_2 \end{bmatrix}$

Axioms 01:

$u + v \in V$

$$
\begin{aligned}
u + v &= \begin{bmatrix} a_1 & 0 \\ 0 & b_1 \end{bmatrix} + \begin{bmatrix} a_2 & 0 \\ 0 & b_2 \end{bmatrix} \\
&= \begin{bmatrix} a_1 + a_2 & 0 \\ 0 & b_1 + b_2 \end{bmatrix}
\end{aligned}
$$

Since u, v in R then $u+v$ in V, hence $u+v$ in V. V is closed under Addition.

Axiom 02:

$u + v = v + u$

$$u + v = \begin{bmatrix} a_1 & 0 \\ 0 & b_1 \end{bmatrix} + \begin{bmatrix} a_2 & 0 \\ 0 & b_2 \end{bmatrix}$$