Prove that $\overrightarrow{u} + \overrightarrow{v} = \overrightarrow{v} + \overrightarrow{u}$ for any $\overrightarrow{u}$ and $\overrightarrow{v}$ in $\mathbb{R}^n$.

Proof:
Let $u, v \in \mathbb{R}^n$.
$\Longrightarrow \overrightarrow{u} = (x_1, x_2, \cdots, x_n)\,, \overrightarrow{v} = (y_1, y_2, \cdots, y_n)\,,$ where all x and y's are members from $\mathbb{R}$.
Here we are to prove the commutative law in $\mathbb{R}^n$:
$\overrightarrow{u} + \overrightarrow{v} = \overrightarrow{v} + \overrightarrow{u},$

while we know that commutative law under addition " + "holds in $\mathbb{R}$ i.e.
$x + y = y + x - - - (1) \quad \forall x, y \in \mathbb{R}$
Now the addition in $\mathbb{R}^n$ is defined as;
$\overrightarrow{u} + \overrightarrow{v} = (x_1, x_2, \cdots, x_n) + (y_1, y_2, \cdots, y_n) = (x_1 + y_1, x_2 + y_2, \cdots, x_n + y_n)$
$\Longrightarrow \overrightarrow{u} + \overrightarrow{v} = (y_1 + x_1, y_2 + x_2, \cdots, y_n + x_n) \quad \because$ by using (1).

$\Longrightarrow \overrightarrow{u} + \overrightarrow{v} = (y_1 + x_1, y_2 + x_2, \cdots, y_n + x_n) = (y_1, y_2, \cdots, y_n) + (x_1, x_2, \cdots, x_n)$
$\Longrightarrow \overrightarrow{u} + \overrightarrow{v} = \overrightarrow{v} + \overrightarrow{u}. \quad \square$