Let $O_{mn} \in M_{mn}(F)$ such that $[O_{mn}]_{ij} = 0$ prove that if $A \in M_{mn}$, then $O_{rm}A = O_{rn}$ and $AO_{nr} = O_{mr}$

Problem Solving - What are the terms/strategies I may need? What do I know?

Matrix product definition/theorem:

$$[AB]_{ij} = \sum_{k=1}^{n} [A]_{ik} [B]_{kj}$$

Let $O_{mn} \in M_{mn}(F)$ such that $[O_{mn}]_{ij} = 0$ prove that if $A \in M_{mn}$, then $O_{rm}A = O_{rn}$ and $AO_{nr} = O_{mr}$

Steps & Process – Try to answer the question writing in many steps to avoid small errors.

Our goal is to show that the product is O_{rn}, thus we need to show that $[O_{rm}A]_{ij} = 0$

$[O_{rm}A]_{ij}$	$= \sum_{k=1}^{m} [O_{rm}]_{ik}[A]_{kj}$	(Matrix product formula)
	$= \sum_{k=1}^{m} (0)[A]_{kj}$	(Definition of O_{mn})
	$= \sum_{k=1}^{m} 0$	(Zero property of a field)
	$= 0$	(Sum of zero is zero)

Thus the product is O_{rn}

Similarly to show that the product is O_{mr}, thus we need to show that $[AO_{nr}]_{ij} = 0$

$[AO_{nr}]_{ij}$	$= \sum_{k=1}^{n} [A]_{ik}[O_{nr}]_{kj}$	(Matrix product formula)
	$= \sum_{k=1}^{n} [A]_{ik}\ (0)$	(Definition of O_{mn})
	$= \sum_{k=1}^{n} 0$	(Zero property of a field)
	$= 0$	(Sum of zero is zero)

Thus the product is O_{mr}

Let $O_{mn} \in M_{mn}(F)$ such that $[O_{mn}]_{ij} = 0$ prove that if $A \in M_{mn}$, then $O_{rm}A = O_{rn}$ and $AO_{nr} = O_{mr}$

Solidify Understanding – Explain why the steps makes sense by connecting to math you know.

Why does our matrix product formula work?

For Video Please click the link below:

Video