

Let $A = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix}$, $B = \begin{pmatrix} 2 & 1 \\ 1 & 3 \end{pmatrix}$ and $C = \begin{pmatrix} 4 & 3 \\ 0 & 2 \end{pmatrix}$. Verify that $AB = AC$ and yet $B \neq C$.

$$\begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 1 & 3 \end{pmatrix} = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix} \begin{pmatrix} 4 & 3 \\ 0 & 2 \end{pmatrix}$$

The image shows a handwritten calculation on lined paper, verifying the matrix equation $AB = AC$. The calculation is as follows:

$$\begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix} \begin{pmatrix} 2 & 1 \\ 1 & 3 \end{pmatrix} = \begin{pmatrix} 1 & 2 \\ 2 & 4 \end{pmatrix} \begin{pmatrix} 4 & 3 \\ 0 & 2 \end{pmatrix}$$
$$\begin{pmatrix} 1 \cdot 2 + 2 \cdot 1 & 1 \cdot 1 + 2 \cdot 3 \\ 2 \cdot 2 + 4 \cdot 1 & 2 \cdot 1 + 4 \cdot 3 \end{pmatrix} = \begin{pmatrix} 1 \cdot 4 + 2 \cdot 0 & 1 \cdot 3 + 2 \cdot 2 \\ 2 \cdot 4 + 4 \cdot 0 & 2 \cdot 3 + 4 \cdot 2 \end{pmatrix}$$
$$\begin{pmatrix} 2 + 2 & 1 + 6 \\ 4 + 4 & 2 + 12 \end{pmatrix} = \begin{pmatrix} 4 + 0 & 3 + 4 \\ 8 + 0 & 6 + 8 \end{pmatrix}$$
$$\begin{pmatrix} 4 & 7 \\ 8 & 14 \end{pmatrix} = \begin{pmatrix} 4 & 7 \\ 8 & 14 \end{pmatrix}$$