

**Question**

Find  $(AB)C$  and  $A(BC)$  where

$$A = \begin{pmatrix} -5 & 1 \\ 9 & -1 \end{pmatrix}; \quad B = \begin{pmatrix} 1 & 2 \\ 3 & 2 \end{pmatrix}; \quad C = \begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix}$$

**Answer**

$$(AB) = \begin{pmatrix} -5 & 1 \\ 9 & -1 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 3 & 2 \end{pmatrix} = \begin{pmatrix} -2 & -8 \\ 6 & 16 \end{pmatrix}$$

$$(AB)C = \begin{pmatrix} -2 & -8 \\ 6 & 16 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix} = \begin{pmatrix} 6 & -8 \\ -10 & 16 \end{pmatrix}$$

NB note order

$A(BC)$  should be the same, but let's check anyway.

$$(BC) = \begin{pmatrix} 1 & 2 \\ 3 & 2 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix} = \begin{pmatrix} -1 & 2 \\ 1 & 2 \end{pmatrix}$$

$$A(BC) = \begin{pmatrix} -5 & 1 \\ 9 & -1 \end{pmatrix} \begin{pmatrix} -1 & 2 \\ 1 & 2 \end{pmatrix} = \begin{pmatrix} 6 & -8 \\ -10 & 16 \end{pmatrix}$$

So  $(AB)C = A(BC)$