

$$A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \quad B = \begin{bmatrix} 1 & 0 \\ -1 & -2 \end{bmatrix} \quad C = \begin{bmatrix} -3 & -5 \\ 2 & 1 \end{bmatrix}$$

$$A \times (B \times C) = (A \times B) \times C$$

$$B \times C = \begin{bmatrix} 1(-3) + 0(2) & 1(-5) + 0(1) \\ (-1)(-3) + (-2)(2) & (-1)(-5) + (-2)(1) \end{bmatrix} = \begin{bmatrix} -3 & -5 \\ -1 & 3 \end{bmatrix}$$

$$A \times (B \times C) = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} -3 & -5 \\ -1 & 3 \end{bmatrix} = \begin{bmatrix} 2(-3) + 3(-1) & 2(-5) + 3(3) \\ 4(-3) + 5(-1) & 4(-5) + 5(3) \end{bmatrix} \\ = \begin{bmatrix} -9 & -1 \\ -17 & -5 \end{bmatrix} \quad (i)$$

$$A \times B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ -1 & -2 \end{bmatrix} = \begin{bmatrix} 2(1) + 3(-1) & 2(0) + 3(-2) \\ 4(1) + 5(-1) & 4(0) + 5(-2) \end{bmatrix} = \begin{bmatrix} -1 & -6 \\ -1 & -10 \end{bmatrix}$$

$$(A \times B) \times C = \begin{bmatrix} -1 & -6 \\ -1 & -10 \end{bmatrix} \begin{bmatrix} -3 & -5 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} (-1)(-3) + (-6)(2) & (-1)(-5) + (-6)(1) \\ (-1)(-3) + (-10)(2) & (-1)(-5) + (-10)(1) \end{bmatrix} \\ = \begin{bmatrix} -9 & -1 \\ -17 & -5 \end{bmatrix} \quad (ii)$$

Q. ed.  $\therefore \Rightarrow A \times (B \times C) = (A \times B) \times C$