2. Let A and B be two 2×2 matrices. Consider the statements

(i) $AB = O \Rightarrow A = O$ or $B = O$

(ii) $AB = I_2 \Rightarrow A = B^{-1}$

(iii) $(A + B)^2 = A^2 + 2AB + B^2$

Then

a. (i) and (ii) are false, (iii) is true

b. (ii) and (iii) are false, (i) is true

c. (i) is false, (ii) and (iii) are true

d. (i) and (iii) are false, (ii) is true

S o l u t i o n   -

d. (i) is false.

If $A = \begin{bmatrix} 0 & 1 \\ 0 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$, then $AB = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = O$

(ii) is true as the product AB is an identity matrix, if and only if B is inverse of the matrix A.

(iii) is false since matrix multiplication in not commutative.