### Step-1

We have to find the matrices that are equal to  $(A+B)^2$ .

We have 
$$(A+B)^2 = (A+B).(A+B)$$

$$= A^2 + A.B + B.A + B^2$$

## Step-2

Given matrix expression is  $A^2 + 2A.B + B^2$ 

Since  $AB \neq BA$ ,  $A^2 + A.B + B.A + B^2 \neq A^2 + 2A.B + B^2$ 

Therefore  $A^2 + 2A.B + B^2 \neq (A+B)^2$ .

## Step-3

Given matrix expression is A(A+B)+B(A+B)

$$A(A+B)+B(A+B)=A.A+A.B+B.A+B^{2}$$

$$= A^2 + A.B + B.A + B^2$$

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

Therefore  $A(A+B)+B(A+B)=(A+B)^2$ .

#### Step-4

Given matrix expression is (A+B)(B+A)

$$(A+B)(B+A) = A(B+A) + B(B+A)$$

$$=A.B+A.A+B.B+B.A$$

$$=A^2+A.B+B.A+B^2$$

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

Therefore  $(A+B)(B+A)=(A+B)^2$ .

# Step-5

Given matrix expression is  $A^2 + AB + BA + B^2$ 

$$A^{2} + AB + BA + B^{2} = A(A+B) + B(A+B)$$

$$=(A+B).(A+B)$$

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

Therefore  $A^2 + AB + BA + B^2 = (A + B)^2$ 

Hence we can conclude that A(A+B)+B(A+B), (A+B)(B+A) and  $A^2+AB+BA+B^2$  always equal  $(A+B)^2$ .