

# EIGEN VALUES AND CAYLEY-HAMILTON THEOREM

## Important Question (PYQ)

If  $\alpha$  is an eigen value of a non-singular matrix  $A$ , then

Prove that  $\frac{|A|}{\alpha}$  is an eigen value of  $\text{adj } A$ .



Proof

$A$  is a non-singular matrix

$\alpha$  is eigen value of  $A$ .

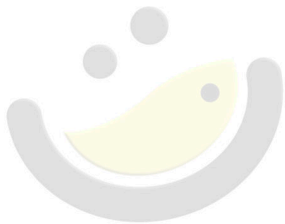
$\therefore \exists$  a non zero  $n \times 1$  Column  
matrix  $X$  s.t.

$$AX = \alpha X$$

$$\text{adj}A (AX) = \text{adj}A (\alpha X)$$

$$(\text{adj}A \cdot A) X = \alpha (\text{adj}A \cdot X)$$

$$(|A|I) X = \alpha (\text{adj}A \cdot X) \quad [A \cdot \text{adj}A = |A|I]$$



$$|A| x = \alpha (\text{adj} A \cdot x)$$

$$\frac{|A|}{\alpha} x = \text{adj} A \cdot x$$

$\Rightarrow \frac{|A|}{\alpha}$  is eigen value of  $\text{adj} A$ .

Hence proved.

