

8. Find non-zero values of x satisfying the matrix equation:

$$x \begin{bmatrix} 2x & 2 \\ 3 & x \end{bmatrix} + 2 \begin{bmatrix} 8 & 5x \\ 4 & 4x \end{bmatrix} = 2 \begin{bmatrix} (x^2 + 8) & 24 \\ (10) & 6x \end{bmatrix}.$$

Solution:

Given,

$$\begin{aligned} & x \begin{bmatrix} 2x & 2 \\ 3 & x \end{bmatrix} + 2 \begin{bmatrix} 8 & 5x \\ 4 & 4x \end{bmatrix} = 2 \begin{bmatrix} x^2 + 8 & 24 \\ 10 & 6x \end{bmatrix} \\ \Rightarrow & \begin{bmatrix} 2x^2 & 2x \\ 3x & x^2 \end{bmatrix} + \begin{bmatrix} 16 & 10x \\ 8 & 8x \end{bmatrix} = \begin{bmatrix} 2x^2 + 16 & 48 \\ 20 & 12x \end{bmatrix} \\ \Rightarrow & \begin{bmatrix} 2x^2 + 16 & 2x + 10x \\ 3x + 8 & x^2 + 8x \end{bmatrix} = \begin{bmatrix} 2x^2 + 16 & 48 \\ 20 & 12x \end{bmatrix} \end{aligned}$$

On comparing the corresponding elements, we get

$$2x + 10x = 48$$

$$12x = 48$$

$$\text{Thus, } x = 4$$

It's also seen that this value of x also satisfies the equation $3x + 8 = 20$ and $x^2 + 8x = 12x$.

Therefore, $x = 4$ (common) is the solution of the given matrix equation.

$$A = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix},$$