Question: Consider the following matrices:

$$A = \begin{bmatrix} 3x & 0 \\ 4 & 0 \end{bmatrix}, \quad B = \begin{bmatrix} 2y & 7 \\ 0 & 1 \end{bmatrix}, \quad C = \begin{bmatrix} 7 & x \\ 2x & 1 \end{bmatrix}$$

and $$D = \begin{bmatrix} 0 & 3y \\ y & 0 \end{bmatrix}$$

(i) If $A + B = C + D$, then find the possible values of x and y.

(ii) If $\det(C) = -1$, then find the possible values of x.

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i) $A+B = \begin{bmatrix} 3x+2y & 7 \\ 4 & 1 \end{bmatrix}$ $\quad C+D = \begin{bmatrix} 7 & x+3y \\ 2x+y & 1 \end{bmatrix}$

$3x+2y = x+3y$ $\quad \therefore 2x+y = 4$ $\quad \Rightarrow x = 1$

$\Rightarrow 2x = y$ $\quad \Rightarrow 2y = 4 \Rightarrow y = 2$ $\quad$ (Ans)

ii) $\det(C) = 7 - 2x^2 = 7$

$\Rightarrow 2x^2 - 8 = 0$

$\Rightarrow 2(x^2 - 4) = 0$

$\Rightarrow x^2 = 4$

$\Rightarrow x = \pm 2$ (Ans)