

Find x, y If

$$\begin{pmatrix} -2 & 0 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} -1 \\ 2x \end{pmatrix} + 3 \begin{pmatrix} -2 \\ 1 \end{pmatrix} = 2 \begin{pmatrix} y \\ 3 \end{pmatrix} . \quad (0.0.1)$$

SOLUTION :

NOTATION : A matrix having m rows and n columns is denoted by $(m \times n)$.

We can multiply two matrices if and only if the matrices are in the form $(p \times q)$ and $(q \times r)$ respectively . [where p, q, r, m, n are arbitrary constants]

we already know ;

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} w & x \\ y & z \end{pmatrix} = \begin{pmatrix} aw + by & ax + bz \\ cw + dy & cx + dz \end{pmatrix} \quad (0.0.2)$$

and,

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \pm \begin{pmatrix} w & x \\ y & z \end{pmatrix} = \begin{pmatrix} a \pm w & b \pm x \\ c \pm y & d \pm z \end{pmatrix} \quad (0.0.3)$$

and, multiplication of matrix with a scalar

$$k \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} ka & kb \\ kc & kd \end{pmatrix} \quad (0.0.4)$$

multiplying $\begin{pmatrix} -2 & 0 \\ 3 & 1 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ 2x \end{pmatrix}$

from (0.0.2);

$$\Rightarrow A = \begin{pmatrix} 2 \\ 2x - 3 \end{pmatrix}$$

multiplying 3 and $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$

from (0.0.4) ;

$$\Rightarrow B = \begin{pmatrix} -6 \\ 3 \end{pmatrix}$$

multiplying 2 and $\begin{pmatrix} y \\ 3 \end{pmatrix}$

from (0.0.4) ;

$$\Rightarrow C = \begin{pmatrix} 2y \\ 6 \end{pmatrix}$$

from (0.0.3) ;

adding A and B ;

$$\begin{pmatrix} 2 \\ 2x - 3 \end{pmatrix} + \begin{pmatrix} -6 \\ 3 \end{pmatrix} = \begin{pmatrix} -4 \\ 2x \end{pmatrix} \quad (0.0.5)$$

LHS: $\begin{pmatrix} -4 \\ 2x \end{pmatrix}$ and

RHS : $\begin{pmatrix} 2y \\ 6 \end{pmatrix}$

comparing **LHS** and **RHS**

we get ;

$-4 = 2y$ and $2x = 6$;

we get ;

$x = 3$ and $y = -2$

$\therefore x = 3$

$y = -2$.

converting the given question into $Ax = b$ form
 given question :

$$\begin{pmatrix} -2 & 0 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} -1 \\ 2x \end{pmatrix} + 3 \begin{pmatrix} -2 \\ 1 \end{pmatrix} = 2 \begin{pmatrix} y \\ 3 \end{pmatrix} \quad (0.0.6)$$

$$\begin{pmatrix} 2 \\ 2x - 3 \end{pmatrix} = \begin{pmatrix} 2y \\ 6 \end{pmatrix} - \begin{pmatrix} -6 \\ 3 \end{pmatrix} \quad (0.0.7)$$

from equation (0.0.2) ;

$$\begin{pmatrix} 2 \\ 2x - 3 \end{pmatrix} = \begin{pmatrix} 2y + 6 \\ 3 \end{pmatrix} \quad (0.0.8)$$

$$\begin{pmatrix} 2 \\ 2x - 3 \end{pmatrix} - \begin{pmatrix} 2y + 6 \\ 3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (0.0.9)$$

from equation (0.0.2) ;

$$\begin{pmatrix} -2y - 4 \\ 2x - 6 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (0.0.10)$$

$$\begin{pmatrix} -2y \\ 2x \end{pmatrix} - \begin{pmatrix} 4 \\ 6 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (0.0.11)$$

$$\begin{pmatrix} -2y \\ 2x \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} + \begin{pmatrix} 4 \\ 6 \end{pmatrix} \quad (0.0.12)$$

from equation (0.0.2);

$$\begin{pmatrix} -2y \\ 2x \end{pmatrix} = \begin{pmatrix} 4 \\ 6 \end{pmatrix} \quad (0.0.13)$$

this can be written as

$$\begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 6 \end{pmatrix} \quad (0.0.14)$$

\therefore we got $Ax = b$ form.