Find x,y If

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

SOLUTION :

NOTATION : A matrix having m rows and n coloumns is denoted by (m×n) .

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

we already know ;

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

and,

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

and, multiplication of matrix with a scalar

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

mulitplying $\begin{pmatrix} -2 & 0 \\ 3 & 1 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ 2x \end{pmatrix}$ from $(0.0.2)$;

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

mulitplying 3 and $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$ from $(0.0.4)$;

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

mulitplying 2 and $\begin{pmatrix} y \\ 3 \end{pmatrix}$ from $(0.0.4)$;

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

from $(0.0.3)$;

adding A and B ;

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

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 :

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

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

from equation 0.02 ;

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

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

from equation 0.02 ;

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

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

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

from equation 0.02 ;

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

this can be written as

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

$\therefore$ we got Ax = b form.