

AI1110 Assignment 1

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Question 2(a): Find x, y If

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

Solution:

- 1) A matrix having m rows and n columns is denoted by $(m \times n)$.
- 2) 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]

(i)

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} w & x \\ y & z \end{pmatrix} = \begin{pmatrix} aw + by & ax + bz \\ cw + dy & cx + dz \end{pmatrix} \quad (2)$$

(ii)

$$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \pm \begin{pmatrix} w & x \\ y & z \end{pmatrix} = \begin{pmatrix} a \pm w & b \pm x \\ c \pm y & d \pm z \end{pmatrix} \quad (3)$$

(iii)

$$k \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} ka & kb \\ kc & kd \end{pmatrix} \quad (4)$$

STEPS :

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

$$A = \begin{pmatrix} 2 & 0 \\ 2x - 3 & 1 \end{pmatrix} \quad (5)$$

- (ii) multiplying 3 and $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$
from (4) ;

$$B = \begin{pmatrix} -6 \\ 3 \end{pmatrix} \quad (6)$$

- (iii) multiplying 2 and $\begin{pmatrix} y \\ 3 \end{pmatrix}$
from (4) ;

$$C = \begin{pmatrix} 2y \\ 6 \end{pmatrix} \quad (7)$$

from (3) ;

adding A and B ;

$$\begin{pmatrix} 2 & 0 \\ 2x - 3 & 1 \end{pmatrix} + \begin{pmatrix} -6 \\ 3 \end{pmatrix} = \begin{pmatrix} -4 \\ 2x \end{pmatrix} \quad (8)$$

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

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

comparing LHS and RHS
we get :

$$-4 = 2y, 2x = 6; \quad (9)$$

we get ;

$$x = 3, y = -2 \quad (10)$$

converting the given question into $Ax = b$ form
by simplification using equation (2) ;

$$\begin{pmatrix} 2 \\ 2x - 3 \end{pmatrix} = \begin{pmatrix} 2y \\ 6 \end{pmatrix} - \begin{pmatrix} -6 \\ 3 \end{pmatrix} \quad (11)$$

$$\begin{pmatrix} 2 \\ 2x - 3 \end{pmatrix} = \begin{pmatrix} 2y + 6 \\ 3 \end{pmatrix} \quad (12)$$

$$\begin{pmatrix} 2 \\ 2x - 3 \end{pmatrix} - \begin{pmatrix} 2y + 6 \\ 3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (13)$$

$$\begin{pmatrix} -2y - 4 \\ 2x - 6 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (14)$$

$$\begin{pmatrix} -2y \\ 2x \end{pmatrix} - \begin{pmatrix} 4 \\ 6 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (15)$$

$$\begin{pmatrix} -2y \\ 2x \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} + \begin{pmatrix} 4 \\ 6 \end{pmatrix} \quad (16)$$

$$\begin{pmatrix} -2y \\ 2x \end{pmatrix} = \begin{pmatrix} 4 \\ 6 \end{pmatrix} \quad (17)$$

this can be written as

$$\begin{pmatrix} 0 & -2 \\ 2 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 6 \end{pmatrix} \quad (18)$$

\therefore we got $Ax = b$ form.