

CASE BASED QUESTIONS-Chapter 3 Matrices

1.	<p>Three students Ram, Mohan and Ankit go to a shop to buy stationary. Ram purchases 2 dozen note books, 1 dozen pens and 4 pencils. Mohan purchases 1 dozen note book , 6 pens and 8 pencils. Ankit purchases 6 note books , 4 pens and 6 pencils. A note book costs ₹ 15, a pen costs ₹4.50 and a pencil costs ₹ 1.50.</p> <p>Let A and B be the matrices representing the number of items purchased by the three students and the prices of items respectively. Based on the above information answer the following questions.</p> <p>(i) What is the order of the matrix B representing the prices of the items</p> <p>(ii) What is the order of the matrix A representing items purchased by the three students</p> <p>(iii) What is the order of the matrix AB.</p> <p style="text-align: center;">OR</p> <p>Find the total amount of bill by all the three students.</p>																
2.	<p>Three schools DPS, CVC and NVS decided to organize a fair for collecting money for helping the food victims. They sold handmade fans , mats and plates from recycled material at a cost of ₹ 25, ₹ 100, and ₹50 each respectively. The number of articles sold are given below:</p> <table border="1" data-bbox="347 936 1315 1104"><thead><tr><th>School/Article</th><th>DPS</th><th>CVC</th><th>NVS</th></tr></thead><tbody><tr><td>Handmade fans</td><td>40</td><td>25</td><td>35</td></tr><tr><td>Mats</td><td>50</td><td>40</td><td>50</td></tr><tr><td>Plates</td><td>20</td><td>30</td><td>40</td></tr></tbody></table> <p>Based on the above information answer the following questions.</p> <p>(i) What is the total money collected by all the three schools.</p> <p>(ii) If the number of handmade fans and plates are interchanged for all the schools, then what is the total money collected by all the three schools.</p>	School/Article	DPS	CVC	NVS	Handmade fans	40	25	35	Mats	50	40	50	Plates	20	30	40
School/Article	DPS	CVC	NVS														
Handmade fans	40	25	35														
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3.	<p>On her birthday ,Seema decided to donate some money to children of an orphanage home. If there were 8 children less , everyone would have got ₹10 more. However if there were 16 children more , everyone would have got ₹10 less. Let the number of children be x and the amount distributed by Seema for one child be ₹ y.</p> <p>(i) Write the matrix equation to represent the information given above.</p> <p>(ii) Find the number of children who were given some money by Seema.</p> <p>(iii) How much amount is given to each child by Seema.</p> <p style="text-align: center;">OR</p> <p>How much amount Seema spends in distributing the money to all the children of Orphanage.</p>																

4.	<p>Gautam buys 5 pens , 3 bags and 1 Instrument box and pays a sum of ₹160 . From the same shop Vikram buys 2 pens , 1 bag and 3 Instrument boxes and pays a sum of ₹190.</p> <p>Ankur buys 1 pen , 2 bags and 4 Instrument boxes and pays a sum of ₹ 250</p> <p>Based on the above information answer the following questions.</p> <p>(i) Write the matrix equation to represent the information given above.</p> <p>(ii) Find $P = A^2 - 5A$</p>																
5.	<p>Two farmers Ramakrishnan and Charan Singh cultivate only three varieties of rice namely Basmati, Permal, and Naura. The sale in Rs of these varieties of rice by both the farmers in the month of September and October are given in the following matrices A and B.</p> $A = \begin{bmatrix} 10000 & 20000 & 30000 \\ 50000 & 30000 & 10000 \end{bmatrix}$ $B = \begin{bmatrix} 5000 & 10000 & 6000 \\ 20000 & 10000 & 10000 \end{bmatrix}$ <p>(i) How the total sales in of September and October for each farmer in each variety can be represented in form of matrix.</p> <p>(ii) How the decrease in sales from September to October can be represented in form of matrix.</p> <p>(iii) If Ramakrishnan receives 2% profit on gross sales, compute his profit for each variety sold in October.</p> <p style="text-align: center;">OR</p> <p>If Charansingh receives 2% profit on gross sales, compute his profit for each variety sold in September</p>																
6.	<p>To promote the making of toilets for women, an organisation tried to generate awareness through (i)house calls (ii) emails and (iii) announcements .</p> <p>The cost for each mode per attempt is given below (i) ₹ 50 (ii) ₹ 20 (iii) ₹40</p> <p>The number of attempts made in the villages X,Y and Z are given below</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>(i)</th> <th>(ii)</th> <th>(iii)</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>400</td> <td>300</td> <td>100</td> </tr> <tr> <td>Y</td> <td>300</td> <td>250</td> <td>75</td> </tr> <tr> <td>Z</td> <td>500</td> <td>400</td> <td>150</td> </tr> </tbody> </table>		(i)	(ii)	(iii)	X	400	300	100	Y	300	250	75	Z	500	400	150
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X	400	300	100														
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Also the chance of making of toilets corresponding to one attempts of given modes is

- (i) 2% (ii) 4% (iii) 20%

Based on the above information answer the following questions :

- (i) What is the cost incurred by the organization on village X
(ii) What is the cost incurred by the village Y
(iii) What is the cost incurred by the village Z

OR

What is the total number of toilets that can be expected after the promotion in village X

7. A trust fund has ₹ 35000 that must be invested in two different types of bonds say X and Y .The first bond pays 10% interest per annum ,which will be given to an old age home and second one pays 8% interest per annum which will be given to women welfare association .Let A be a 1×2 and B be a 2×1 matrix representing the investment and interest rate on each bond respectively.

Based on the above information answer the following questions

- (i) What is the total amount of interest received on both bonds if ₹15000 is invested in bond X .
(ii) What is the amount of investment in bond Y if the amount of interest given to old age home is ₹500.

8. A manufacturer produces three stationary products Pencil, Eraser, and Sharpener which he sells in two markets. Annual sales are indicated below:

Products in numbers given below in the table

Market	Pencil	Eraser	Sharpener
A	10,000	2,000	18,000
B	6,000	20,000	8,000

	<p>If the unit sale price of Pencil, Eraser, and Sharpener are ₹2.50, ₹1.50 and ₹1.00 respectively .</p> <p>(i) Write the matrix equation to represent the information given above.</p> <p>(ii) Find the total revenue of market A and B</p>												
9.	<p>Amit, Biraj and Chirag were given the task of creating square matrix of order 2. Below are the matrices created by them namely A , B and C respectively.</p> $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}, B = \begin{bmatrix} 4 & 0 \\ 1 & 5 \end{bmatrix}, C = \begin{bmatrix} 2 & 0 \\ 1 & -2 \end{bmatrix}$ <p>(i) Find $A + B + C$</p> <p>(ii) Evaluate $(A^T)^T$</p> <p>(iii) Find $AC - BC$</p> <p style="text-align: center;">OR</p> <p>Find the matrix $(a+b) B$, $a = 4$, $b = -2$</p>												
10.	<p>A manufacturer produces three stationary products Pencil, Eraser, and Sharpener which he sells in two markets. Annual sales are indicated below:</p> <p style="text-align: center;">Products in numbers given below in the table</p> <table border="1" data-bbox="352 1294 1385 1527"> <thead> <tr> <th>Market</th> <th>Pencil</th> <th>Eraser</th> <th>Sharpener</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>10,000</td> <td>2,000</td> <td>18,000</td> </tr> <tr> <td>B</td> <td>6,000</td> <td>20,000</td> <td>8,000</td> </tr> </tbody> </table> <p>If the unit cost of the above three commodities are ₹2.00, ₹1.00 and ₹0.50 respectively and If the unit sale price of Pencil, Eraser, and Sharpener are ₹2.50, ₹1.50 and ₹1.00 respectively .</p> <p>(i) Find the cost incurred in Market A and B.</p> <p>(ii) Find the profit in Market A and B.</p>	Market	Pencil	Eraser	Sharpener	A	10,000	2,000	18,000	B	6,000	20,000	8,000
Market	Pencil	Eraser	Sharpener										
A	10,000	2,000	18,000										
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ANSWERS

1.	$B = \begin{bmatrix} 15 \\ 4.5 \\ 1.3 \end{bmatrix}, A = \begin{bmatrix} 24 & 12 & 4 \\ 12 & 6 & 8 \\ 6 & 4 & 6 \end{bmatrix}$ <p>(i) 3×1 (ii) 3×3 (iii) 3×1 or ₹ 756.</p>
2.	<p>(i) $M = [25 \quad 100 \quad 50], A = \begin{bmatrix} 40 & 25 & 35 \\ 50 & 40 & 50 \\ 20 & 30 & 40 \end{bmatrix}, MA =$ $[7000 \quad 6125 \quad 7875]$</p> <p>Total money collected by all the three schools. = ₹ 21000</p> <p>(ii) $B = \begin{bmatrix} 20 & 30 & 40 \\ 50 & 40 & 50 \\ 40 & 25 & 35 \end{bmatrix}, MB = [7500 \quad 6000 \quad 7750]$</p> <p>Total money collected by all the three schools. = ₹ 21250.</p>
3.	<p>$(x-8)(y+10) = xy, \rightarrow 5x-4y = 40$ $(x+16)(y-10) = xy, \rightarrow 5x-8y = -80$</p> <p>(i) $\begin{bmatrix} 5 & -4 \\ 5 & -8 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 40 \\ -80 \end{bmatrix}$ (ii) 32 (iii) Rs. 30 Or ₹ 960</p>
4.	<p>(i) $\begin{bmatrix} 5 & 3 & 1 \\ 2 & 1 & 3 \\ 1 & 2 & 4 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 160 \\ 190 \\ 250 \end{bmatrix}$</p> <p>(ii) $A^2 - 5A = \begin{bmatrix} 32 & 20 & 18 \\ 15 & 13 & 17 \\ 13 & 13 & 23 \end{bmatrix} - \begin{bmatrix} 25 & 15 & 5 \\ 10 & 5 & 15 \\ 5 & 10 & 20 \end{bmatrix} = \begin{bmatrix} 7 & 5 & 13 \\ 5 & 8 & 2 \\ 8 & 3 & 3 \end{bmatrix}$</p>
5.	<p>(i) $A + B = \begin{bmatrix} 15000 & 30000 & 36000 \\ 70000 & 40000 & 20000 \end{bmatrix}$</p> <p>(ii) $A - B = \begin{bmatrix} 5000 & 10000 & 24000 \\ 30000 & 20000 & 0 \end{bmatrix}$</p> <p>(iii) In October Profit of ₹100, ₹200, ₹120 received by Ramakrishnan in the sale of each variety of rice.</p>
6.	<p>Let ₹ A, ₹ B and ₹ C be the cost incurred by the organisations for villages X, Y, Z respectively. Then A, B, C will be given by the matrix equation</p> $\begin{bmatrix} 400 & 300 & 100 \\ 300 & 250 & 75 \\ 500 & 400 & 150 \end{bmatrix} \begin{bmatrix} 50 \\ 20 \\ 40 \end{bmatrix} = \begin{bmatrix} A \\ B \\ C \end{bmatrix}$

Hence $\begin{bmatrix} A \\ B \\ C \end{bmatrix} = \begin{bmatrix} 30000 \\ 23000 \\ 39000 \end{bmatrix}$

(i) 30000

(ii) 23000

(iii) 39000

OR

The total number of toilets that can be expected in each village is given by the following matrix equation

$$\begin{bmatrix} 400 & 300 & 100 \\ 300 & 250 & 75 \\ 500 & 400 & 150 \end{bmatrix} \begin{bmatrix} 2/100 \\ 4/100 \\ 20/100 \end{bmatrix} = \begin{bmatrix} A \\ B \\ C \end{bmatrix}$$

Therefore $X = 40$, $Y = 31$ $Z = 56$

Therefore $X = 40$

7. If ₹ 15000 is invested in bond X then amount invested in bond

$$Y = 35000 - 15000 = 20000$$

Let A = investment = [15000 20000] and $B = \begin{bmatrix} 10\% \\ 8\% \end{bmatrix} = \begin{bmatrix} 0.1 \\ 0.08 \end{bmatrix}$

The amount of interest received on both bonds is given by

$$AB = [15000 \ 20000] \begin{bmatrix} 0.1 \\ 0.08 \end{bmatrix} = [3100]$$

Therefore (i) Total amount = ₹3100

Let ₹x is invested in bond X then we have $x \times 10/100 = 500$

Therefore $X = ₹5000$ Therefore amount invested in bond

$$Y = 35000 - 5000 = 30000$$

Ans: (ii) ₹30000

8. (i) $\begin{bmatrix} 10000 & 2000 & 18000 \\ 6000 & 20000 & 8000 \end{bmatrix} \begin{bmatrix} 2.50 \\ 1.50 \\ 1.00 \end{bmatrix} = \begin{bmatrix} 46000 \\ 53000 \end{bmatrix}$

(ii) Revenue of Market A = $\begin{bmatrix} 10000 & 2000 & 18000 \end{bmatrix} \begin{bmatrix} 2.50 \\ 1.50 \\ 1.00 \end{bmatrix} =$

₹46000

	$\text{Revenue of Market B} = [6000 \quad 20000 \quad 8000] \begin{bmatrix} 2.50 \\ 1.50 \\ 1.00 \end{bmatrix} = ₹53000$ <p>Total revenue of market A and B = ₹ 99000</p>
9.	<p>(i) $A+B+C = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix} + \begin{bmatrix} 4 & 0 \\ 1 & 5 \end{bmatrix} + \begin{bmatrix} 2 & 0 \\ 1 & -2 \end{bmatrix} = \begin{bmatrix} 7 & 2 \\ 1 & 6 \end{bmatrix}$</p> <p>(ii) $A^T = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$, $(A^T)^T = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix} = A$</p> <p>(iii) $AC - BC$</p> $= \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix} \begin{bmatrix} 2 & 0 \\ 1 & -2 \end{bmatrix} - \begin{bmatrix} 4 & 0 \\ 1 & 5 \end{bmatrix} \begin{bmatrix} 2 & 0 \\ 1 & -2 \end{bmatrix}$ $= \begin{bmatrix} 4 & -4 \\ 1 & -6 \end{bmatrix} - \begin{bmatrix} 8 & 0 \\ 7 & -10 \end{bmatrix} = \begin{bmatrix} -4 & -4 \\ -6 & 4 \end{bmatrix}$ <p style="text-align: center;">OR</p> $(a+b) B = (4-2) \begin{bmatrix} 4 & 0 \\ 1 & 5 \end{bmatrix} = 2 \begin{bmatrix} 4 & 0 \\ 1 & 5 \end{bmatrix} = \begin{bmatrix} 8 & 0 \\ 2 & 10 \end{bmatrix}$
10.	<p>(i) Cost incurred in Market A = $[10000 \quad 2000 \quad 18000] \begin{bmatrix} 2.00 \\ 1.00 \\ 0.50 \end{bmatrix}$</p> $= ₹31000$ <p>Cost incurred in Market B = $[6000 \quad 20000 \quad 8000] \begin{bmatrix} 2.00 \\ 1.00 \\ 0.50 \end{bmatrix}$</p> $= ₹36000$ <p>(ii) Revenue of Market A = $[10000 \quad 2000 \quad 18000] \begin{bmatrix} 2.50 \\ 1.50 \\ 1.00 \end{bmatrix} =$</p> $₹46000$ <p>Revenue of Market B = $[6000 \quad 20000 \quad 8000] \begin{bmatrix} 2.50 \\ 1.50 \\ 1.00 \end{bmatrix} = ₹53000$</p> <p>Profit in market A = ₹46000 - ₹31000 = ₹15000</p> <p>Profit in market B = ₹53000 - ₹36000 = ₹17000</p>