CHAPTER-3
MATRICES
04 MARK TYPE QUESTIONS

Q. NO	QUESTION	MARK
1.	On her birthday, Seema decided to donate some money to children of an orphanage home. If there were 8 children less, everyone would have ot Rs.10 more. However, if there were 16 children more, everyone would got Rs.10 less. Let the number of children be x and the amount distributed by Seema for one child be y. 1. Find the equation related to the given problem in terms x and y. 2. find the number of children. How much amount is given to each child by seema?	4
2.	Two farmers Ramakishan and Gurucharan singh cultivate only three varieties of rice namely Basmati, Permal and Naura. The sale of these varieties of rice by both the farmers in the month of September and October are given by the following matrices A and B. September sales in Rupees: $A = \begin{bmatrix} 10000 & 20000 & 30000 \\ 50000 & 30000 & 10000 \end{bmatrix}$ October sales in rupees $B = \begin{bmatrix} 5000 & 10000 & 6000 \\ 20000 & 10000 & 10000 \end{bmatrix}$ 1.The total sales in September and October for each farmer in each variety can be represented as A) A+B B) A-B C) A>B D) A<B 2. What is the value of A_{23} ? A) 10,000 B) 20,000 C) 30,000 D) 40,000 3. The decrease in sales from September to October is given by A) A+B B) A-B C) A>B D) A<B 4. If Ramakishan receives 2% profit on gross sales, compute his profit for each variety sold in October. A) Rs.100, Rs.200, Rs.120 B) Rs.100, Rs.200, Rs.130 C) Rs.100, Rs.220, Rs.120 D) Rs.110, Rs.200, Rs.120	4
3.	DIET PROBLEMS :- There are 2 families A and B. There are 4 men, 6 women and 2 children in family A, and 2 men, 2 women 4 children in family B. The recommend daily amount of calories is 2200 for men, 2500 for women, 2000 for children and 75 grams of proteins for men, 70 grams for women and 35 grams for children. Represent the above information using matrix. Using matrix multiplication, calculate the total requirement of calories and proteins for each of the two families. What awareness can you create among people about the planned diet from this question?	4

4.	HELPING THE DISABLED :- A trust caring for handicapped children gets Rs.30000 every month from its donors. The trust spends half of the funds received for medical & educational care of the children & for that it charges 2% of the spent amount from them, & deposited the balance amount in a private bank to get the money multiplied so that the trust goes on functioning regularly. What percent of interest should the trust get from the bank so as to get a total of Rs. 1800 every month? Use the matrix method to find the rate of interest. 	4
5.	Express the matrix $A = \begin{bmatrix} 2 & 4 & -6 \\ 7 & 3 & 5 \\ 1 & -2 & 4 \end{bmatrix}$ as the sum of a symmetric and skew-symmetric matrix.	4
6.	The sum of three numbers is 2. If we subtract the second number from twice the first number, we get 3. By adding double the second number and the third number we get 0. Represent it algebraically and find the numbers using matrix method.	4
7.	Express the following matrix as the sum of symmetric and a skew-symmetric matrix:	4
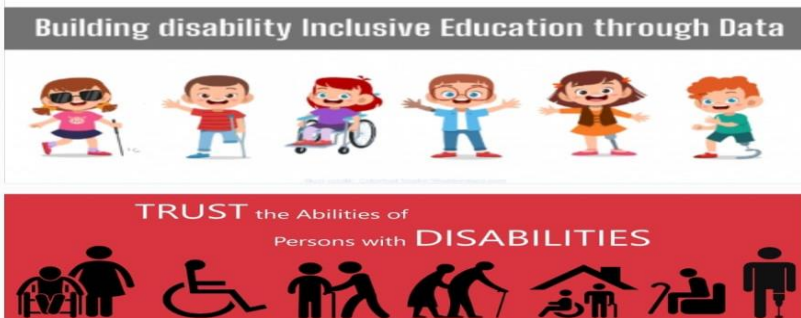
$$\begin{bmatrix} 3 & 3 & -1 \\ -2 & -2 & 1 \\ -4 & -5 & 2 \end{bmatrix}$$

8.	If, A=$\begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$ find $A^2 - 5A + 16I$.	4
9.	Amit, Biju, Chirag are classmates. Each of them was asked to write a square matrix of order 2. They wrote the following matrices. A=$\begin{pmatrix} 1 & 2 \\ -1 & 3 \end{pmatrix}$ B=$\begin{pmatrix} 4 & 0 \\ 1 & 5 \end{pmatrix}$ and c=$\begin{pmatrix} 2 & 0 \\ 1 & -2 \end{pmatrix}$.If a=4 and b=-2, based on the above information answer the following question: I) Find the sum of matrices A,B and C II) Find the value of A^T Find AC-BC.	4
10.	Define Lower triangular matrix and upper triangular matrix? give example.	4
11.	If$A = \begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ and I is the identity matrix of order 2, show that $I + A = (I - A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$.	4
12.	Find the value of x, if $\begin{bmatrix} 1 & x & 1 \end{bmatrix}\begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix}\begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$	4
13.	Ram purchases 3 pens, 2 bags, and 1 instrument box and pays ₹ 41. From the same shop, Dheeraj purchases 2 pens, 1 bag, and 2 instrument boxes and pays ₹ 29, while Ankur purchases 2 pens, 2 bags, and 2 instrument boxes and pays ₹ 44. Read the above information and answer the following questions: (i) Find the cost of one pen. (1 mark) (ii) What are the cost of one pen and one bag? (1 mark) (iii) What is the cost of one pen & one instrument box? (2 marks)	
14.	Three friends Ravi, Raju and Rohit were buying and selling stationery items in a market. The price of per dozen of Pen, notebooks and toys are Rupees x, y and z respectively. Ravi purchases 4 dozen of notebooks and sells 2 dozen pens and 5 dozen toys. Raju purchases 2 dozen toys and sells 3 dozen pens and 1 dozen of notebooks. Rohit purchases one dozen of pens and sells 3 dozen notebooks and one dozen toys. In the process, Ravi, Raju and Rohit earn ₹ 1500, ₹ 100 and ₹400 respectively.	

	(i) What is the price of one dozen pens? (1 mark)
	 (ii) What is the total price of one dozen pens and one dozen of notebooks?
	       (1 mark)
	 (iii) What is the sale amount of Ravi?
	       (2 marks)	

15.	Three schools DPS, CVC and KVS decided to organize a fair for collecting money for helping the flood victims. They sold handmade fans, mats and plates from recycled material at a cost of Rs. 25, Rs.100 and Rs. 50 each respectively. The numbers of articles sold are given as School /Article DPS CVC KVS Handmade fans 40 25 35 Mats 50 40 50 Plates 20 30 40 Based on the information given above, answer the following questions: (i). What is the total money (in Rupees) collected by the school DPS? (ii). If the number of handmade fans and plates are interchanged for all the schools, then what is the total money collected by all schools? (iii). How many articles (in total) are sold by three schools?	4
16.	There are two families A and B. There are 4 men, 6 women and 2 children in family A and 2 men, 2 women and 4 children in family B. The recommended daily amount of calories is 2400 for men, 1900 for women and 1800 for children 45 grams of protein for men, 55 grams for women and 33 grams for children. (i) Represent the above information using matrices (ii) Calculate the total requirement of calories and proteins for each of the two families.	4

ANSWERS:

Q. NO	ANSWER	MARKS
1.	1. 5x-4y=40 and 5x-8y=-80	2
	2. x=32 and y =30	2
2.	1- A 2-A 3-B 4-A	4
3.	Ans:-	
	The given data can be represented as-	
	Family member:-	

	Men	women	Children
A	4	6	2
B	2	2	4

Diet to in-take:-

	Calories	protien
Men	2200	75
Women	2500	70
children	2000	35

This can be solved in matrix multiplication as

$$\begin{bmatrix} 4 & 6 & 2 \\ 2 & 2 & 4 \end{bmatrix} \begin{bmatrix} 2200 & 75 \\ 2500 & 70 \\ 2000 & 35 \end{bmatrix} = \begin{bmatrix} 27800 & 790 \\ 17400 & 430 \end{bmatrix}$$

Thus family A required 27800calories and 790gms of protein ; family B required 17400calories and 430gms of protein.

Q. NO	ANSWER	MARKS
4.	Ans:-	4

Let us assume that the earning of trust from all the charges is x and earning of trust from the interest obtained from the bank is y.

Total fund received is RS.30000

X= 2% of RS.15000 = 300

As matrix it can be represented as

$$\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1800 \\ 300 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 300 \\ 1500 \end{bmatrix}$$

Let R be the rate of interest by the bank

As y=1500 =$\frac{R}{100}X15000 = 150$ $i.e.$ R =10%

So, the rate of interest the trust get by the bank is 10%.

Q. NO	ANSWER	MARKS
5.	$\frac{1}{2}(A+A^{'})+\frac{1}{2}(A-A^{'})$	4

$$\begin{bmatrix} 2 & \frac{11}{2} & -\frac{5}{2} \\ \frac{11}{2} & 3 & \frac{3}{2} \\ \frac{-5}{2} & \frac{3}{2} & 4 \end{bmatrix} + \begin{bmatrix} 0 & -\frac{3}{2} & -\frac{7}{2} \\ \frac{3}{2} & 0 & \frac{7}{2} \\ \frac{7}{2} & -\frac{7}{2} & 0 \end{bmatrix} = \begin{bmatrix} 2 & 4 & -6 \\ 7 & 3 & 5 \\ 1 & -2 & 4 \end{bmatrix}$$

Q. NO	ANSWER	MARKS
6.	X+Y+Z=2	4
	2X-Y=3	
	2Y+2=0	

	$x = 1, y = -2, z = 2$	
7.	$A= \begin{bmatrix} 3 & 3 & -1 \\ -2 & -2 & 1 \\ -4 & -5 & 2 \end{bmatrix}$ =P+Q $P=\frac{1}{2}\begin{bmatrix} 6 & 1 & -5 \\ 1 & -4 & -4 \\ -5 & -4 & 4 \end{bmatrix}$ $Q=-\frac{1}{2}\begin{bmatrix} 0 & 5 & 4 \\ -5 & 0 & 6 \\ 3 & 6 & 0 \end{bmatrix}$ Here P is a symmetric matrix and Q is skew symmetric matrix	4
8.	$A = \begin{pmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{pmatrix}.$ $A^2 = \begin{pmatrix} 5 & -1 & 2 \\ 9 & -2 & 5 \\ 0 & -1 & -2 \end{pmatrix}.$ $A^2 - 5A + 16I$ $= \begin{pmatrix} 5 & -1 & 2 \\ 9 & -2 & 5 \\ 0 & -1 & -2 \end{pmatrix} - 5\begin{pmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{pmatrix} + 16\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ $= \begin{pmatrix} 1 & -1 & -3 \\ -1 & -1 & -10 \\ -5 & 4 & 4 \end{pmatrix}.$	4
9.	$A=\begin{pmatrix} 1 & 2 \\ -1 & 3 \end{pmatrix}$ $B=\begin{pmatrix} 4 & 0 \\ 1 & 5 \end{pmatrix}$ and $c=\begin{pmatrix} 2 & 0 \\ 1 & -2 \end{pmatrix}$ $A+B+C=\begin{pmatrix} 1 & 2 \\ -1 & 3 \end{pmatrix}+\begin{pmatrix} 4 & 0 \\ 1 & 5 \end{pmatrix} + \begin{pmatrix} 2 & 0 \\ 1 & -2 \end{pmatrix} = \begin{pmatrix} 7 & 2 \\ 1 & 6 \end{pmatrix}$ $A^T=\begin{pmatrix} 1 & -1 \\ 2 & 3 \end{pmatrix}$ AC-BC= $\begin{pmatrix} 4 & -4 \\ 1 & -6 \end{pmatrix} - \begin{pmatrix} 8 & 0 \\ 7 & -10 \end{pmatrix}=\begin{pmatrix} -4 & -4 \\ -6 & 4 \end{pmatrix}$	4
10.	A square matrix in which all the elements above the diagonal elements are zero is a lower triangular matrix. Ex: A=$\begin{bmatrix} 5 & 0 & 0 \\ 1 & -3 & 0 \\ 2 & 4 & 2 \end{bmatrix}$ A square matrix in which all the elements below the diagonal elements are zero is a upper triangular matrix. Ex: $\begin{bmatrix} 5 & 2 & 1 \\ 0 & 2 & 3 \\ 0 & 0 & 3 \end{bmatrix}$	4

11.	L.H.S. = I + A = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ + $\begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ = $\begin{bmatrix} 1 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 1 \end{bmatrix}$ I - A = $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ - $\begin{bmatrix} 0 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 0 \end{bmatrix}$ = $\begin{bmatrix} 1 & \tan\frac{\alpha}{2} \\ -\tan\frac{\alpha}{2} & 1 \end{bmatrix}$ R.H.S. = $(I - A)\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ = $\begin{bmatrix} 1 & \tan\frac{\alpha}{2} \\ -\tan\frac{\alpha}{2} & 1 \end{bmatrix}\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ $\qquad$ = $\begin{bmatrix} 1 & -\tan\frac{\alpha}{2} \\ \tan\frac{\alpha}{2} & 1 \end{bmatrix}$ Hence, L.H.S. = R.H.S. Verified	4
12.	$$[1 \quad x \quad 1]\begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix}\begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$$ Or, $[\,1+2x+15 \quad 3+5x+3 \quad 2+x+2\,]\begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$ Or, $[\,x^2 +16x+28\,]$ = O Or, $x^2 +16x+28 = 0$ Or, $(x +2)(x +14) = 0$ Or, x = -2, - 14	4
13.	$\qquad$ **(i)** ₹ 2 $\qquad\qquad$ (ii) ₹17 $\qquad\qquad$ (iii) ₹7	1+1+2
14.	$\qquad$ (i) ₹ 100 $\qquad$ (ii) ₹ 300 $\qquad\qquad$ (iii)₹ 1200	1+1+2
15.	(i) Total money collected by the school DPS is Rs. 7000 (ii) Total money collected by all the schools is Rs. 18500 (iii) The total articles sold by the schools is 330	4
16.	(i) The matrices are $P = \begin{bmatrix} 4 & 6 & 2 \\ 2 & 2 & 4 \end{bmatrix}$ $Q = \begin{bmatrix} 2400 \\ 1900 \\ 1800 \end{bmatrix}$ and $R = \begin{bmatrix} 45 \\ 55 \\ 33 \end{bmatrix}$ (ii) Here $PQ = \begin{bmatrix} 4 & 6 & 2 \\ 2 & 2 & 4 \end{bmatrix}\begin{bmatrix} 2400 \\ 1900 \\ 1800 \end{bmatrix}$ $\qquad$ = $\begin{bmatrix} 24600 \\ 15800 \end{bmatrix}$ And PR = $\begin{bmatrix} 4 & 6 & 2 \\ 2 & 2 & 4 \end{bmatrix}\begin{bmatrix} 45 \\ 55 \\ 33 \end{bmatrix}$ $\qquad$ = $\begin{bmatrix} 576 \\ 332 \end{bmatrix}$ Hence total requirement of calories and protein for family A are 24600 and 576 grams respectively and total requirement of calories and protein for family B are 15800 and 332 grams respectively.	4