INDIAN SCHOOL AL WADI AL KABIR

Class XII, Mathematics ***Worksheet 2- Matrices and Determinants***

25-04-2021

Short answer type (1 or 2 marks)

Q.1. Write $A^{-1} if\ A = \begin{pmatrix} 5 & 4 \\ 2 & 2 \end{pmatrix}$

Q.2 Evaluate using properties: $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+a & 1 \\ 1 & 1 & 1+b \end{vmatrix}$

Q.3 If A = $[1 \quad 2 \quad 3], and\ B = \begin{pmatrix} 0 & 2 & 1 \\ 0 & 1 & 0 \\ -1 & 0 & 0 \end{pmatrix}$ then find the product AB.

Q.4 If A = $\begin{pmatrix} 2 & \alpha & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{pmatrix}$ then find the value(s) of $\alpha\ if\ A^{-1}\ exists.$

Q.5 $If\ A + B = \begin{bmatrix} 1 & 6 \\ -1 & -2 \end{bmatrix}\ and\ A - B = \begin{bmatrix} 1 & -1 \\ 5 & 2 \end{bmatrix}, then\ find\ A\ and\ B$

Q.6 $If\ A = \begin{pmatrix} 1 & 0 & 1 \\ 2 & 1 & 3 \\ -1 & 2 & 3 \end{pmatrix}, then\ write\ A.adjA$

Q.7 Using determinants, determine whether (1, 4), (-2, -2) and (0, 2) are collinear or not

Q.8 Prove using properties: $\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = (1 - x^3)^2$

Q.9 If a, b, c are in AP, then prove: $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix} = 0$

Case study-based question

Q.10 On his birthday Hari decided to donate some money to children of an orphanage home. If there were 10 children less, everyone would have got ₹ 30 more. However, if there were 10 children more, everyone would have got ₹ 20 less.

Based on the above information answer the following:

Let the number of students be x and the amount distributed toeach child = ₹ y.

(i) The algebraic equations in terms of x and y are

A. x+ y =30; x-y =20 **B.** 3x-y=30; 2x-y= -20 **C.** x-3y =30; x-2y = -20 **D.** x+3y = 300; 2x+y = 20

(ii) Which of the following represents the matrix form of the algebraic equations?

A. $\begin{pmatrix}1 & 1\\ 1 & -1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}30\\ -20\end{pmatrix}$ **B.** $\begin{pmatrix}3 & -1\\ 2 & -1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}30\\ -20\end{pmatrix}$ **C** $\begin{pmatrix}1 & 1\\ 1 & -1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}30\\ -20\end{pmatrix}$ **D** $\begin{pmatrix}1 & 1\\ 1 & -1\end{pmatrix}\begin{pmatrix}x\\ y\end{pmatrix} = \begin{pmatrix}30\\ -20\end{pmatrix}$

(iii) The number of students in the orphanage is

A. 20 **B.** 30 **C.** 40 **D.** 50

(iv) Amount received by each child is ₹_____

A. 90 **B.** 100 **C.** 120 **D.** 150

(v) Total amount donated ₹ _____

A. 6000 **B.** 5000 **C.** 7500 **D.** 10000

11. Two schools A and B decided to award prizes to their students for three games hockey (x), cricket (y) and tennis (z). School A decided to award a total of ₹ 11000 for the three games to 5, 4 and 3 students respectively while school B decided to award ₹ 10700 for the three games to 4, 3 and 5 students respectively. Also, all the three prizes together amount to ₹2700.

Using the information given above, answer the following:

(i). A student Robin, of class XII is asked by his teacher to represent the above situation by a matrix equation. He tries and submits his answer. The teacher marks his answer correct. Which of the following maybe his answer?

A) $\begin{pmatrix}5 & 4 & 3\\ 4 & 3 & 5\\ 1 & 1 & 1\end{pmatrix}\begin{pmatrix}x\\ y\\ z\end{pmatrix} = \begin{pmatrix}10700\\ 11000\\ 2700\end{pmatrix}$ B) $\begin{pmatrix}5 & 4 & 3\\ 4 & 3 & 5\\ 1 & 1 & 1\end{pmatrix}\begin{pmatrix}x\\ y\\ z\end{pmatrix} = \begin{pmatrix}11000\\ 10700\\ 2700\end{pmatrix}$

C) $\begin{pmatrix}5 & 4 & 3\\ 4 & 3 & 5\\ 1 & 1 & 1\end{pmatrix}\begin{pmatrix}x\\ y\\ z\end{pmatrix} = \begin{pmatrix}1100\\ 10700\\ 2700\end{pmatrix}$ D) $\begin{pmatrix}5 & 4 & 3\\ 4 & 3 & 5\\ 1 & 1 & 1\end{pmatrix}\begin{pmatrix}x\\ y\\ z\end{pmatrix} = \begin{pmatrix}10700\\ 2700\\ 11000\end{pmatrix}$

(ii) The teacher then asks another student Rita to form linear equations for the information given above. Which of the following maybe the correct choice for her?

A) $5x + 4y + 3z = 11000, 4x + 3y + 5z = 10700, x + y + z = 2700.$
B) $5x + 4y + 3z = 10700, 4x + 3y + 5z = 11000. x + y + z = 2700$
C) $5x + 4y + 3z = 1100, 4x + 3y + 5z = 10700, x + y + z = 2700$
D) $5x + 4y + 3z = 10700, 4x + 3y + 5z = 11000, x + y + z = 2700$

(iii). A student Jiva is tested by the teacher, as he asks her, "Is the given system of equations consistent or inconsistent?" What could be Jiva's correct answer?

A) The system of equations is consistent with unique solution
B) The system of equations is consistent with infinitely many solution
C) The system of equations is inconsistent with no solution
D) The system of equations has trivial solutions.

iv) The prize amount for the hockey is

A) ₹800 B) ₹ 900 C) ₹ 1000 D) ₹700

v) The prize amount for the cricket is

A) ₹800 B) ₹ 900 C) ₹ 1000 D) ₹700

Long answer type (3 Marks)

Q12. Prove using properties: $\begin{vmatrix} x & x^2 & 1+px^3 \\ y & y^2 & 1+py^3 \\ z & z^2 & 1+pz^3 \end{vmatrix} = (1+pxyz)(x-y)(y-z)(z-x).$

Q13. Solve the following system of linear equations by Cramer's rule:
$x + y + 2z = 8, 2x - y + z = 7, x - y - z = 0$

Q14. For the two-sector economy input- output table is given below.

$Output \rightarrow$ $Input \downarrow$	Industry 1	Industry 2	Final Demand	Total output
Industry 1	10	25	15	50
Industry 2	20	30	10	600

Determine the outputs when the final demand changes to 35 for industry 1 and 42 for industry 2.

Q15. $Find\ the\ matrix\ X\ if\ X \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{bmatrix}.$

Long answer type(5marks)

Q16. The sum of three numbers is 6. If we multiply third number by 3 and add second number to it, we get 11. By adding first and third numbers, we get double of the second number. Represent it algebraically and find the numbers using matrix method.

Q17. Obtain the inverse of the following matrix using elementary row operation:

$$A = \begin{pmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{pmatrix}$$

Q18. If A = $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$. Prove $A^3 - 6A^2 + 5A + 11I = 0. Hence\ find\ A^{-1}$.

Q19. If A = $\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{bmatrix}$ $and\ B = \begin{bmatrix} 7 & -3 & 2 \\ 3 & 0 & -3 \\ -1 & 3 & 1 \end{bmatrix}$,

$then\ find\ AB. Hence\ solve\ the\ equations\ given\ below.$

$x + y + z = 6$

$y + 3z = 11$

$x - 2y + z = 0$

Q20. If A = $\begin{bmatrix} 1 & 1 & 2 \\ 1 & -2 & 0 \\ 3 & -1 & 1 \end{bmatrix}$ find A^{-1} and hence solve the system of equations

$$x + y + 2z = 1;\ x - 2y = 0\ and\ 3x - y + z = 4$$

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Answers

Answers

1	$\begin{pmatrix} 1 & -2 \\ -1 & \frac{5}{2} \end{pmatrix}$	**2**	ab	**3.**	[-3 4 1]	**4**	$\alpha \neq -2$	
5	$A = \begin{pmatrix} 1 & \frac{5}{2} \\ 2 & 0 \end{pmatrix}$ $\boldsymbol{B} = \begin{pmatrix} 0 & \frac{7}{2} \\ -3 & -2 \end{pmatrix}$	**6**	$\begin{pmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{pmatrix}$	**7**	$collinear$	**10.**	(i) B (ii) B (iii) D (iv) C (v) A	
11.	(i) B (ii) A (iii) A (iv) C (v) B	**13.**	$x = 3,$ $y = 1,$ $z = 2$	**14**	Industry 1-150 Industry 2- 204	**15**	X= $\begin{pmatrix} 1 & -2 \\ 2 & 0 \end{pmatrix}$	
16	x=1, y=2, z= 3	**17**	$A^{-1} = \begin{bmatrix} \frac{1}{2} & \frac{-1}{2} & \frac{1}{2} \\ -4 & 3 & -1 \\ \frac{5}{2} & \frac{-3}{2} & \frac{1}{2} \end{bmatrix}$	**18.**	$\frac{1}{11}\begin{bmatrix} -3 & 4 & 5 \\ 9 & -1 & -4 \\ 5 & -3 & -1 \end{bmatrix}$	**19.**	$x = 1$ Y=2 Z=3	**20.** $x = 2,$ $y = 1$ $, z = -1$

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