S.D. Public School, Pitampura Class XII 2025-26

Applied Mathematics

Holiday's Homework Assignment

1. Find the unit digit in each of the following:
(i) 11¹³²
(ii) 22¹²

(iii) 7²⁹¹

- **2.** Show that $5^{700} \equiv 6 \pmod{23}$
- **3.** Find the remainder when 5^{121} is divided by 23
- **4.** Find the least non negative remainder when 3^{15} is divided by 7.
- **5.** Solve: $2x \equiv 37 \pmod{11}$
- **6.** If $57 \equiv x \pmod{4}$, then find the least positive value of *x*.
- **7.** In what ratio must water be mixed with milk to gain 20% by selling the mixture at cost price? (Assume cost of water to be 0)
- 8. It is 7:00 pm currently. What time (in am or pm) will it be in next 1500 hours?
- **9.** A man can row $9\frac{1}{3}$ km/h in still water and finds that it takes him thrice as much time to row up than as to row down the same distance in river, Find the speed of the current.
- 10. Two pipes A and B can fill a tank in 24 minutes and 32 minutes respectively. If both the pipes are opened simultaneously, after how much time should B be closed so that the tank is full in 18 minutes?
- In a one-kilometre race, A beats B by 30 seconds and B beats C by 15 seconds. If A beats C by 180 metres, then find the time taken by A to run 1 kilometre.
- **12.** A runs 4 times fast as B. If A gives B a start of 60 metres, how far must the goal on the race course be so that A and B reach it at the same time?
- **13.** Solve for $x: \frac{2x+4}{x-1} \ge 5$
- **14.** If $\frac{|x+1|}{x+1} > 0$, $x \in R$, then find the solution set of x
- **15.** Two pipes can fill a cistern in 12 minutes and 15 minutes respectively. A third pipe can empty the cistern in 20 minutes. How long will it take to fill the cistern if all the three pipes are opened at the same time?
- **16.** In a 1 km race, player P beats player Q by 18 metres or 9 seconds. What is P's time to complete the race?
- **17.** If AB = A and BA = B, then what is $B^2 + B$?
- 18. What time will it be after 1275 hours, if the present time is 9:00 pm?
- **19.** A bottle is full of Dettol. One-third of its Dettol is taken away and an equal amount of water is poured into the bottle to fill it again. This operation is repeated three times. Find the final ratio of Dettol to water in the bottle.

- **20.** If A and B are square matrices each of order 3 such that |A| = -1 and |B| = 3. What is the value of |3AB|?
- **21.** Determine the integral value(s) of *x* for which the matrix A is singular:

$$A = \begin{bmatrix} x+1 & -3 & 4\\ -5 & x+2 & 2\\ 4 & 1 & x-6 \end{bmatrix}$$

22. Construct a 3 × 4 matrix $A = [a_{ij}]$ whose elements a_{ij} are given by:

(i)
$$a_{ij} = \frac{|2i-3j|}{2}$$
 (ii) $a_{ij} = \frac{(i-2j)}{3}$

- 23. If A and B are two symmetric matrices of the same order. Then show that AB – BA is skew-symmetric matrix
- **24.** Express the matrix $A = \begin{bmatrix} 4 & 2 & -1 \\ 3 & 5 & 7 \\ 1 & -2 & 1 \end{bmatrix}$ as the sum of a symmetric and a skew-

symmetric matrix.

- **25.** If the points (x, -2), (5,2) and (8,8) are collinear, then find the value of x using determinants.
- **26.** Solve the following system of equations by Cramer's Rule:

$$\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4, \frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1 \text{ and } \frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2$$
27. For the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$ show that $A^3 - 6A^2 + 5A + 11I_3 = 0$. Hence find A^{-1}

find A

- 28. The sum of three numbers is 2. If twice the second number is added to the sum of the first and third, the sum is 1. By adding second and third number to five times the first number, we get 6. Find the three numbers by using matrix method.
- **29.** The prices of the three commodities P, Q and R are $\exists x, y$ and z respectively. A purchases 4 units of R and sells 3 units of P and 5 units of Q. B purchases 3 units of Q and sells 2 units of P and 1 unit of R. C purchases 1 unit of P and sells 4 units of Q and 6 units of R. In the process A, B and C earn ₹ 6000, ₹ 5000 and ₹ 13000 respectively. If selling the units is positive earning and buying the units is negative earning, find the price per unit of three commodities be using matrix method.

On her birthday, Prema decides to donate some money to children of an orphanage home.



If there are 8 children less, everyone gets ₹ 10 more. However, if there are 16 children more, everyone gets ₹ 10 less.

Let the number of children in the orphanage home be x and the amount to be donated to each child be \gtrless y.

Based on the above information, answer the following questions :

- (i) Write the system of linear equations in x and y formed of the given situation.
- (ii) Write the system of linear equations, obtained in (i) above, in matrix form AX = B.
- $(iii) \quad (a) \qquad Find \ the \ inverse \ of \ matrix \ A.$

OR

(b) Determine the values of x and y.

Note: Practice relevant questions of Chapter 3 and 4 from NCERT Core Math book including examples.

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Applied Mathematics

Holiday's Homework Project

Prepare a project on any one of the suggested projects: List of Suggested projects:

- 1. Prepare a questionnaire to collect information about money spent by your friends in a month on activities like travelling, movies, recharging of the mobiles, etc. and draw interesting conclusions
- 2. Check out the local newspaper and cut out examples of information depicted by graphs. Draw your own conclusions from the graph and compare it with the analysis given in the report
- **3.** Analysis of population migration data positive and negative influence on urbanization
- 4. Each day newspaper tells us about the maximum temperature, minimum temperature, and humidity. Collect the data for a period of 30 days and represent it graphically. Compare it with the data available for the same time period for the previous year
- 5. Analysis of career graph of a cricketer (batting average for a batsman and bowling average for a bowler). Conclude the best year of his career. It may be extended for other players also tennis, badminton, athlete
- 6. Vehicle registration data correlating with pollution and the number of accidents
- 7. Visit a village near Delhi and collect data of various crops over the past few years from the farmers. Also, collect data about temperature variation and rain over the period for a particular crop. Try to find the effect of temperature and rain variations on various crops
- 8. Choose any week of your ongoing semester. Collect data for the past 10 15 years for the amount of rainfall received in Delhi during that week. Predict the amount of rainfall for the current year
- 9. Weather prediction (prediction of monsoon from past data)
- **10.** Visit Kirana shops near your home and collect the data regarding the sales of certain commodities over a month. Try to figure out the stock of a particular commodity which should be in the store in order to maximize the profit
- **11.** Predicting the outcome of an election exit polls.
- **12.** Predicting mortality of infants.