Name_____ Hour _____ Date_____

3-6 Solving Systems Using Matrices

- A matrix is a combination of rows and columns used to arrange data. These arrangements can be mathematically manipulated to solve problems.

- The size or dimensions of a matrix are always reported as number of rows by number of columns (rows X columns). Rows are horizontal ($\leftrightarrow$), while columns are vertical ($\updownarrow$). Below, matrix A is 2 X 3 and matrix B is 3 X 4.

- When finding an element in a matrix, use the name of the matrix followed by subscripts listing the row and column of the entry. Number 1 below, A_{13}, wants to know which entry is in the 1st row and 3rd column of matrix A. The answer is 8.

- Below, Matrix B represents the system: $\begin{matrix} \mathbf{0x+6y+3z=2} \\ \mathbf{4x+5y+1z=13} \\ \mathbf{2x+2y+0z=-10} \end{matrix}$ which is the same as $\begin{matrix} \mathbf{6y+3z=2} \\ \mathbf{4x+5y+z=13} \\ \mathbf{2x+2y=-10} \end{matrix}$.

Identify the indicated element.

$A = \left[\begin{array}{cc|c} 3 & 5 & 8 \\ 4 & 1 & 6 \end{array}\right]$ $B = \left[\begin{array}{ccc|c} 0 & 6 & 3 & 2 \\ 4 & 5 & 1 & 13 \\ 2 & 2 & 0 & -10 \end{array}\right]$

1. A_{13} **2.** B_{24} **3.** B_{12} **4.** A_{22}

5. B_{31} **6.** A_{21} **7.** B_{23} **8.** A_{11}

Write a matrix to represent each system.

9. $\begin{cases} 3x+y=-4 \\ -2x+4y=7 \end{cases}$ **10.** $\begin{cases} 6x=11 \\ -3x+4y=2 \end{cases}$ **11.** $\begin{cases} 4x-y+2z=10 \\ 5x+2y-3z=0 \\ x-3y+z=6 \end{cases}$

Write the system of equations represented by each matrix.

12. $\left[\begin{array}{ccc|c} 2 & 5 & 0 & 13 \\ -3 & 1 & 2 & 6 \\ 4 & 0 & -3 & 5 \end{array}\right]$ **13.** $\left[\begin{array}{cc|c} 2 & 1 & -7 \\ 0 & 4 & 9 \end{array}\right]$ **14.** $\left[\begin{array}{ccc|c} 6 & 4 & -2 & 17 \\ 1 & -5 & 2 & -10 \\ 0 & 3 & -1 & 0 \end{array}\right]$

Graphing Calculator Solve each system.

15. $\begin{cases} 4x - y = 10 \\ -2x + 5y = 4 \end{cases}$

16. $\begin{cases} x - 2y + 3z = 18 \\ 9x + 2y - z = -2 \\ -6x - y + 2z = 4 \end{cases}$

17. $\begin{cases} 3x - 4y + z = 15 \\ -2x - 6y + 3z = 4 \\ 2x + 2y - 2z = -1 \end{cases}$

18. $\begin{cases} 4x + y - 2z = 3 \\ 2y + z = 4 \\ 3x - 3y - z = 9 \end{cases}$

19. $\begin{cases} 5x - 2y + z = -1 \\ -x - y - 2z = 5 \\ 3x + 2y + 2z = 2 \end{cases}$

20. $\begin{cases} 3x + 5z = -4 \\ -2x + y - 3z = 9 \\ -x - 2y + 9z = 0 \end{cases}$

21. Suppose the movie theater you work at sells popcorn in three different sizes. A small costs \$2, a medium costs \$5, and a large costs \$10. On your shift, you sold 250 total containers of popcorn and brought in \$1726. You sold twice as many large containers as small ones.

System:

a. How many of each popcorn size did you sell?

b. How much money did you bring in from selling small size containers?

22. Open Ended Write a matrix for a system of equations that does not have a unique solution.
(Hint: Recall what a system graph of two lines looked like that had infinitely many solutions or no solutions.)

System:

23. The following matrix shows the prices passengers on an airline flight paid for a recent ticket and how many passengers were on that flight. Some passengers paid full price for their tickets, and some bought their tickets during a half-price sale. How many passengers bought each price of ticket?

$$\left[\begin{array}{cc|c} 1 & 1 & 100 \\ 120 & 240 & 20{,}160 \end{array}\right]$$

24. Error Analysis Your friend says that the matrix below represents the system of equations. What error did your friend make? What is the correct system of equations?

$$\left[\begin{array}{ccc|c} 4 & 0 & -1 & 4 \\ -3 & 2 & -2 & -2 \\ 1 & -3 & -2 & -6 \end{array}\right] \qquad \begin{cases} 4x + y - z = 4 \\ -3x + 2y - 2z = -2 \\ x - 3y - 2z = -6 \end{cases}$$