

Unit 5 Matrices Help Session Test Review Worksheet

Solve for X, given the following matrices. If not possible, state the reason why. Show work!

Key

Given the Following Matrices, complete the indicated operations.

$$A = \begin{bmatrix} 2 & -5 \\ 4 & 3 \end{bmatrix} \quad B = \begin{bmatrix} 6 & -8 \\ -2 & 4 \end{bmatrix} \quad C = \begin{bmatrix} 6 & 8 & -4 \\ 2 & -4 & 10 \end{bmatrix} \quad D = \begin{bmatrix} -2 & -4 & -4 & 2 \\ 6 & -8 & 12 & 4 \\ 4 & 6 & 8 & 14 \end{bmatrix}$$

$$E = \begin{bmatrix} -5 & 2 & -4 & 1 \\ 3 & 6 & 7 & -13 \\ -5 & 8 & -7 & -2 \end{bmatrix} \quad F = \begin{bmatrix} -3 & -1 & 5 & 7 \\ 5 & 3 & 11 & -3 \\ -1 & -9 & 7 & 15 \end{bmatrix} \quad G = \begin{bmatrix} -7 & 3 & -5 \\ -3 & -9 & 1 \end{bmatrix}$$

$$X = \begin{bmatrix} 25/2 & 2 1/2 & -7/2 \\ 9/2 & -3/2 & 29/2 \end{bmatrix}$$

1) $2X = 3C - G$

$$2X = 3 \begin{bmatrix} 6 & 8 & -4 \\ 2 & -4 & 10 \end{bmatrix} - \begin{bmatrix} -7 & 3 & -5 \\ -3 & -9 & 1 \end{bmatrix}$$

$$2X = \begin{bmatrix} 18 & 24 & -12 \\ 6 & -12 & 30 \end{bmatrix} - \begin{bmatrix} -7 & 3 & -5 \\ -3 & -9 & 1 \end{bmatrix}$$

$$2X = \begin{bmatrix} 25 & 21 & -7 \\ 9 & -3 & 29 \end{bmatrix}$$

$$X = \frac{1}{2} \begin{bmatrix} 25 & 21 & -7 \\ 9 & -3 & 29 \end{bmatrix}$$

2) $2X = AG$

$$\begin{bmatrix} 2 & -5 \\ 4 & 3 \end{bmatrix} \begin{bmatrix} -7 & 3 & -5 \\ -3 & -9 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 2(-7)+5(3) & 2(3)+5(9) & 2(-5)-5(1) \\ 4(-7)+3(-3) & 4(3)+3(-9) & 4(-5)+3(1) \end{bmatrix}$$

$$2X = \begin{bmatrix} 1 & 51 & -15 \\ -37 & -15 & -17 \end{bmatrix}$$

$$X = \frac{1}{2} \begin{bmatrix} 1 & 51 & -15 \\ -37 & -15 & -17 \end{bmatrix}$$

$$X = \begin{bmatrix} 1/2 & 51/2 & -15/2 \\ -37/2 & -15/2 & -17/2 \end{bmatrix}$$

3) $X = A^{-1}$

$$\det A = 2(3) - 4(-5)$$

$$\det A = 26$$

$$A^{-1} = \frac{1}{26} \begin{bmatrix} 3 & 5 \\ -4 & 2 \end{bmatrix} = \begin{bmatrix} 3/26 & 5/26 \\ -4/26 & 2/26 \end{bmatrix}$$

4) $AX = B$

$$X = [A^{-1}][B]$$

$$\begin{bmatrix} 3 & 5 \\ -4 & 2 \end{bmatrix} \begin{bmatrix} 6 & -8 \\ -2 & 4 \end{bmatrix}$$

$$\begin{bmatrix} 6(3)+5(-2) & 3(-8)+5(4) \\ 6(-4)+2(-2) & -8(-4)+2(4) \end{bmatrix}$$

$$X = \frac{1}{26} \begin{bmatrix} 8 & -4 \\ -28 & 40 \end{bmatrix}$$

$$X = \begin{bmatrix} 8/26 & -4/26 \\ -28/26 & 40/26 \end{bmatrix} = \begin{bmatrix} 4/13 & -2/13 \\ -14/13 & 20/13 \end{bmatrix}$$

5) Find inverse of matrix A if $A = \begin{bmatrix} -2 & b \\ 3 & 7 \end{bmatrix}$

$$\det(A) = -2(7) - 3(b)$$

$$= -14 - 3b$$

$$A^{-1} = \frac{1}{-14-3b} \begin{bmatrix} 7 & -b \\ -3 & -2 \end{bmatrix}$$

Change only the value of the element in G_{12} that would make matrix G singular.

6. $G = \begin{bmatrix} -3 & 7 \\ -8 & 4 \end{bmatrix}$

$\begin{bmatrix} -3 & x \\ -8 & 4 \end{bmatrix} \rightarrow -3(4) - (-8x) = 0$

$\begin{cases} -12 + 8x = 0 \\ 8x = +12 \end{cases}$

$x = +12/8$
 $x = +3/2$

7) The determinant of $\begin{bmatrix} 3 & 1 & 0 \\ 3 & x & -2 \\ -5 & -1 & 2 \end{bmatrix}$ is 6. Solve for x .

* $\begin{bmatrix} 3 & 1 & 0 & 3 & 1 \\ 3 & x & -2 & 3 & x \\ -5 & -1 & 2 & -5 & -1 \end{bmatrix}$

$6x + 10 + 0 - (0 + 6 + 6) = 6$
 $6x + 10 - 12 = 6$

$\begin{cases} 6x = 8 \\ x = 8/6 = 4/3 \end{cases}$

Write each matrix equation, then solve the system of equations using an Inverse Matrix. Show work!!

8. $2y + 17 = x$
 $3x + 5 = -y$

$\begin{bmatrix} -1 & 2 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -17 \\ -5 \end{bmatrix}$

$\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{-1(2) - 3(1)} \begin{bmatrix} 1 & -2 \\ -3 & -1 \end{bmatrix} \begin{bmatrix} -17 \\ -5 \end{bmatrix}$

$\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{-7} \begin{bmatrix} -7 \\ 56 \end{bmatrix}$

$-1x + 2y = 17$
 $3x + 1y = -5$

$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 & 2 \\ 3 & 1 \end{bmatrix}^{-1} \begin{bmatrix} -17 \\ -5 \end{bmatrix}$

$\begin{bmatrix} 1 & -2 \\ -3 & -1 \end{bmatrix} \begin{bmatrix} -17 \\ -5 \end{bmatrix} \rightarrow \begin{bmatrix} -7 \\ 56 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ -8 \end{bmatrix}$

For #9 and #10: Set up using matrix equations. Then solve using calculators.

9) Patrick has stashed away \$16.60 in nickels, dimes, and quarters in his sock drawer. The sum of the nickels and dimes is four less than three times the number of quarters. The total number of coins is 136. Find the number of each kind of coin.

$n = \#$ of nickels
 $d = \#$ of dimes
 $q = \#$ of quarters

$\begin{cases} n + d + q = 136 \\ 0.05n + 0.10d + 0.25q = 16.60 \\ 1n + 1d - 3q = -4 \end{cases}$

$n + d = 3q - 4$

$\begin{bmatrix} n \\ d \\ q \end{bmatrix} = \begin{bmatrix} 45 \\ 56 \\ 35 \end{bmatrix}$ nickels
 dimes
 quarters

$\begin{bmatrix} 1 & 1 & 1 \\ 0.05 & 0.10 & 0.25 \\ 1 & 1 & -3 \end{bmatrix} \begin{bmatrix} n \\ d \\ q \end{bmatrix} = \begin{bmatrix} 136 \\ 16.60 \\ -4 \end{bmatrix}$

10) Jasper picked strawberries on three days. He picked a total of 87 quarts. On Tuesday he picked 15 quarts more than on Monday. On Wednesday he picked 3 quarts fewer than on Tuesday. How many quarts did he pick each day?

$m = \#$ of quarts picked Monday
 $t = \#$ picked Tuesday
 $w = \#$ picked Wednesday

$\begin{cases} m + t + w = 87 \\ -1m + t + 0w = 15 \\ 0m - 1t + 1w = -3 \end{cases}$

$t = m + 15$
 $w = t - 3$

$\begin{bmatrix} 1 & 1 & 1 \\ -1 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix} \begin{bmatrix} m \\ t \\ w \end{bmatrix} = \begin{bmatrix} 87 \\ 15 \\ -3 \end{bmatrix}$

$\begin{bmatrix} m \\ t \\ w \end{bmatrix} = \begin{bmatrix} 20 \\ 35 \\ 32 \end{bmatrix}$ # quarts (Mon)
 # quarts (Tues)
 # quarts (Wed)