10-5 Additional Practice

Inverse Matrices and Systems of Equations

Solve the matrix equation $A \cdot X = B$ for the given matrices.

1. $A = \begin{bmatrix} 9 & -4 \\ -3 & 6 \end{bmatrix}$

$B = \begin{bmatrix} -30 \\ 3 \end{bmatrix}$

$X =$

2. $A = \begin{bmatrix} -4 & 6 \\ 2 & -8 \end{bmatrix}$

$B = \begin{bmatrix} 336 \\ 132 \end{bmatrix}$

$X =$

3. $A = \begin{bmatrix} -10 & 6 \\ -5 & -4 \end{bmatrix}$

$B = \begin{bmatrix} 10 \\ -100 \end{bmatrix}$

$X =$

Express the system of linear equations as a matrix equation.

4. $\begin{cases} 6x + 9y = 36 \\ 4x + 13y = 2 \end{cases}$

5. $\begin{cases} 3x - 4y = -9 \\ 7y = 24 \end{cases}$

6. $\begin{cases} 4x - z = 9 \\ 12x + 2y = 17 \\ x - y + 12z = 3 \end{cases}$

Solve the following systems of linear equations using inverse matrices, if possible.

7. $\begin{cases} x + 3y = 5 \\ x + 4y = 6 \end{cases}$

8. $\begin{cases} x - 3y = -1 \\ -6x + 19y = 6 \end{cases}$

9. $\begin{cases} -3x + 4y - z = -5 \\ x - y - z = 8 \\ 2x + y + 2z = 9 \end{cases}$

10. The difference between twice Bill's age and Carlos's age is 26. The sum of Anna's age, three times Bill's age, and Carlos's age is 92. The total of the three ages is 52.

a. Write a matrix equation to represent this situation.

b. How old is each person?

11. Explain how you can use a matrix equation to show that the lines represented by $y = -3x + 4$ and $4y = -4x - 8$ intersect.

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Inverse Matrices and Systems of Equations

Solve the matrix equation $A \cdot X = B$ for the given matrices.

1. $A = \begin{bmatrix} 9 & -4 \\ -3 & 6 \end{bmatrix}$, $B = \begin{bmatrix} -30 \\ 3 \end{bmatrix}$

$X = \begin{bmatrix} -4 \\ -\frac{3}{2} \end{bmatrix}$

2. $A = \begin{bmatrix} -4 & 6 \\ 2 & -8 \end{bmatrix}$, $B = \begin{bmatrix} 336 \\ 132 \end{bmatrix}$

$X = \begin{bmatrix} -174 \\ -60 \end{bmatrix}$

3. $A = \begin{bmatrix} -10 & 6 \\ -5 & -4 \end{bmatrix}$, $B = \begin{bmatrix} 10 \\ -100 \end{bmatrix}$

$X = \begin{bmatrix} 8 \\ 15 \end{bmatrix}$

Express the system of linear equations as a matrix equation.

4. $\begin{cases} 6x + 9y = 36 \\ 4x + 13y = 2 \end{cases}$

$\begin{bmatrix} 6 & 9 \\ 4 & 13 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 36 \\ 2 \end{bmatrix}$

5. $\begin{cases} 3x - 4y = -9 \\ 7y = 24 \end{cases}$

$\begin{bmatrix} 3 & -4 \\ 0 & 7 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -9 \\ 24 \end{bmatrix}$

6. $\begin{cases} 4x - z = 9 \\ 12x + 2y = 17 \\ x - y + 12z = 3 \end{cases}$

$\begin{bmatrix} 4 & 0 & -1 \\ 12 & 2 & 0 \\ 1 & -1 & 12 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 9 \\ 17 \\ 3 \end{bmatrix}$

Solve the following systems of linear equations using inverse matrices, if possible.

7. $\begin{cases} x + 3y = 5 \\ x + 4y = 6 \end{cases}$

$x = 2, y = 1$

8. $\begin{cases} x - 3y = -1 \\ -6x + 19y = 6 \end{cases}$

$x = -1, y = 0$

9. $\begin{cases} -3x + 4y - z = -5 \\ x - y - z = 8 \\ 2x + y + 2z = 9 \end{cases}$

$x = 7, y = 3, z = -4$

10. The difference between twice Bill's age and Carlos's age is 26. The sum of Anna's age, three times Bill's age, and Carlos's age is 92. The total of the three ages is 52.

a. Write a matrix equation to represent this situation. $\begin{bmatrix} 0 & 2 & -1 \\ 1 & 3 & 1 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} \begin{bmatrix} 26 \\ 92 \\ 52 \end{bmatrix}$

b. How old is each person? **Anna: 18; Bill: 20; Carlos: 14**

11. Explain how you can use a matrix equation to show that the lines represented by $y = -3x + 4$ and $4y = -4x - 8$ intersect.

Answers may vary. Sample: Write the matrix equation $\begin{bmatrix} 3 & 1 \\ 4 & 4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \begin{bmatrix} 4 \\ -8 \end{bmatrix}$ to solve the system. If the equation has a solution (x, y), then the lines intersect at that point. A solution exists if the determinant of the coefficient matrix $\begin{bmatrix} 3 & 1 \\ 4 & 4 \end{bmatrix}$ does not equal zero.