## 3-6 Solving Systems of Equations Using Inverse Matrices

**Determine whether the matrices in each pair are inverses.**

1. $A=\begin{bmatrix}2 & 1\\ -1 & 0\end{bmatrix}, B=\begin{bmatrix}1 & 2\\ 2 & 1\end{bmatrix}$

*ANSWER:*

no

3. $F=\begin{bmatrix}-1 & 1\\ 0 & -1\end{bmatrix}, G=\begin{bmatrix}-1 & -1\\ 0 & -1\end{bmatrix}$

*ANSWER:*

yes

**Find the inverse of each matrix, if it exists.**

5. $\begin{bmatrix}6 & -3\\ -1 & 0\end{bmatrix}$

*ANSWER:*

$\begin{bmatrix}0 & -1\\ -\frac{1}{3} & -2\end{bmatrix}$

7. $\begin{bmatrix}-3 & 0\\ 5 & 2\end{bmatrix}$

*ANSWER:*

$\begin{bmatrix}-\frac{1}{3} & 0\\ \frac{5}{6} & \frac{1}{2}\end{bmatrix}$

**Use a matrix equation to solve each system of equations.**

9. $-2x + y = 9$
$x + y = 3$

*ANSWER:*

$(-2, 5)$

11. $-2x + y = -4$
$3x + y = 1$

*ANSWER:*

$(1, -2)$

**Determine whether each pair of matrices are inverses of each other.**

13. $K=\begin{bmatrix}1 & 2\\ 3 & 0\end{bmatrix}, L=\begin{bmatrix}0 & 1\\ 2 & -1\end{bmatrix}$

*ANSWER:*

no

15. $P=\begin{bmatrix}4 & 0\\ 3 & 0\end{bmatrix}, Q=\begin{bmatrix}-1 & -1\\ \frac{2}{3} & 5\end{bmatrix}$

*ANSWER:*

no

**Find the inverse of each matrix, if it exists.**

17. $\begin{bmatrix}3 & 0\\ 0 & 2\end{bmatrix}$

*ANSWER:*

$\begin{bmatrix}\frac{1}{3} & 0\\ 0 & \frac{1}{2}\end{bmatrix}$

19. $\begin{bmatrix}3 & 0\\ 5 & 1\end{bmatrix}$

*ANSWER:*

$\begin{bmatrix}\frac{1}{3} & 0\\ -\frac{5}{3} & 1\end{bmatrix}$

21. $\begin{bmatrix}-5 & -4\\ 4 & 2\end{bmatrix}$

*ANSWER:*

$\begin{bmatrix}\frac{1}{3} & \frac{2}{3}\\ -\frac{2}{3} & -\frac{5}{6}\end{bmatrix}$

23. $\begin{bmatrix} 6 & -5 \\ 4 & 9 \end{bmatrix}$

*ANSWER:*

$\begin{bmatrix} \frac{9}{74} & \frac{5}{74} \\ -\frac{2}{37} & \frac{3}{37} \end{bmatrix}$

25. $\begin{bmatrix} -6 & 8 \\ 8 & -7 \end{bmatrix}$

*ANSWER:*

$\begin{bmatrix} \frac{7}{22} & \frac{4}{11} \\ \frac{4}{11} & \frac{3}{11} \end{bmatrix}$

**CCSS PERSEVERANCE Use a matrix equation to solve each system of equations.**

27. $-x + y = 4$
$-x + y = -4$

*ANSWER:*

no solution

29. $x + y = 4$
$-4x + y = 9$

*ANSWER:*

$(-1, 5)$

31. $y - x = 5$
$2y - 2x = 8$

*ANSWER:*

no solution

33. $1.6y - 0.2x = 1$
$0.4y - 0.1x = 0.5$

*ANSWER:*

$(-5, 0)$

35. $2y - 4x = 3$
$4x - 3y = -6$

*ANSWER:*

$\left(\frac{3}{4}, 3\right)$

37. **MUSIC** The diagram shows the trends in digital audio player and portable CD player ownership over the past five years for Central City. Every person in Central City has either a digital audio player or a portable CD player. Central City has a stable population of 25,000 people, of whom 17,252 own digital audio players and 7748 own portable CD players.


**a.** Write a matrix to represent the transitions in player ownership.
**b.** Assume that the trends continue. Predict the number of people who will own digital audio players next year.
**c.** Use the inverse of the matrix from part **b** to find the number of people who owned digital audio players last year.

*ANSWER:*

**a.**

| | From CD | From MP3 |
|---|---|---|
| To CD | 0.35 | 0.12 |
| To MP3 | 0.65 | 0.88 |

**b.** about 20,218
**c.** about 4357

39. **CHALLENGE** Describe what a matrix equation with infinite solutions looks like.

*ANSWER:*

The system would have to consist of two equations that are the same or one equation that is a multiple of the other.

41. **OPEN ENDED** Write a matrix equation that does not have a solution.

*ANSWER:*

Sample answer: $\begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 9 \\ 10 \end{bmatrix}$; any matrix that has a determinant equal to 0, such as $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$.

43. The Yogurt Shoppe sells cones in three sizes: small, $0.89; medium, $1.19; and large, $1.39. One day Santos sold 52 cones. He sold seven more medium cones than small cones. If he sold $58.98 in cones, how many medium cones did he sell?
**A** 11
**B** 17
**C** 24
**D** 36

*ANSWER:*
C

45. **SHORT RESPONSE** What is the solution of the system of equations $6a + 8b = 5$ and $10a - 12b = 2$?

*ANSWER:*
$\left(\frac{1}{2}, \frac{1}{4}\right)$

**Evaluate each determinant.**

47. $\begin{vmatrix} 8 & -3 \\ 6 & -9 \end{vmatrix}$

*ANSWER:*
−54

49. $\begin{bmatrix} 8 & 6 & -1 \\ -4 & 5 & 1 \\ -3 & -2 & 9 \end{bmatrix}$

*ANSWER:*
551

**Find each product, if possible.**

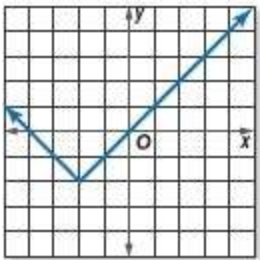
51. $\begin{bmatrix} 8 & -2 \\ -4 & -5 \end{bmatrix} \cdot \begin{bmatrix} -2 \\ 3 \end{bmatrix}$

*ANSWER:*
$\begin{bmatrix} -22 \\ -7 \end{bmatrix}$

53. **MILK** The Yoder Family Dairy produces at most 200 gallons of skim and whole milk each day for delivery to large bakeries and restaurants. Regular customers require at least 15 gallons of skim and 21 gallons of whole milk each day. If the profit on a gallon of skim milk is $0.82 and the profit on a gallon of whole milk is $0.75, how many gallons of each type of milk should the dairy produce each day to maximize profits?

*ANSWER:*
179 gal of skim and 21 gal of whole milk

**Identify the type of function represented by each graph.**

55. 


*ANSWER:*
absolute value