In Exercises 15, 17, 18, 22, and 31, the inverse matrix does not exist.
In Exercises 47, 48, 53, and 54, the system has no solution.

# 8.3 /// EXERCISES

**In Exercises 1–8, show that $B$ is the inverse of $A$.**

**1.** $A = \begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix}, \quad B = \begin{bmatrix} 3 & -1 \\ -5 & 2 \end{bmatrix}$

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

**3.** $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} -2 & 1 \\ \frac{3}{2} & -\frac{1}{2} \end{bmatrix}$

**4.** $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}, \quad B = \begin{bmatrix} \frac{3}{5} & \frac{1}{5} \\ -\frac{2}{5} & \frac{1}{5} \end{bmatrix}$

**5.** $A = \begin{bmatrix} -2 & 2 & 3 \\ 1 & -1 & 0 \\ 0 & 1 & 4 \end{bmatrix}, \quad B = \frac{1}{3}\begin{bmatrix} -4 & -5 & 3 \\ -4 & -8 & 3 \\ 1 & 2 & 0 \end{bmatrix}$

**6.** $A = \begin{bmatrix} 2 & -17 & 11 \\ -1 & 11 & -7 \\ 0 & 3 & -2 \end{bmatrix}, \quad B = \begin{bmatrix} 1 & 1 & 2 \\ 2 & 4 & -3 \\ 3 & 6 & -5 \end{bmatrix}$

**7.** $A = \begin{bmatrix} 2 & 0 & 1 & 1 \\ 3 & 0 & 0 & 1 \\ -1 & 1 & -2 & 1 \\ 4 & -1 & 1 & 0 \end{bmatrix},$

$B = \begin{bmatrix} -1 & 2 & -1 & -1 \\ -4 & 9 & -5 & -6 \\ 0 & 1 & -1 & -1 \\ 3 & -5 & 3 & 3 \end{bmatrix}$

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

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

**In Exercises 9–24, find the inverse of the matrix (if it exists).**

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

**10.** $\begin{bmatrix} 1 & 2 \\ 3 & 7 \end{bmatrix}$

**11.** $\begin{bmatrix} 1 & -2 \\ 2 & -3 \end{bmatrix}$

**12.** $\begin{bmatrix} -7 & 33 \\ 4 & -19 \end{bmatrix}$

**13.** $\begin{bmatrix} -1 & 1 \\ -2 & 1 \end{bmatrix}$

**14.** $\begin{bmatrix} 11 & 1 \\ -1 & 0 \end{bmatrix}$

**15.** $\begin{bmatrix} 2 & 4 \\ 4 & 8 \end{bmatrix}$

**16.** $\begin{bmatrix} 2 & 3 \\ 1 & 4 \end{bmatrix}$

**17.** $\begin{bmatrix} 2 & 7 & 1 \\ -3 & -9 & 2 \end{bmatrix}$

**18.** $\begin{bmatrix} -2 & 5 \\ 6 & -15 \\ 0 & 1 \end{bmatrix}$

**19.** $\begin{bmatrix} 1 & 1 & 1 \\ 3 & 5 & 4 \\ 3 & 6 & 5 \end{bmatrix}$

**20.** $\begin{bmatrix} 1 & 2 & 2 \\ 3 & 7 & 9 \\ -1 & -4 & -7 \end{bmatrix}$

**21.** $\begin{bmatrix} 1 & 0 & 0 \\ 3 & 4 & 0 \\ 2 & 5 & 5 \end{bmatrix}$

**22.** $\begin{bmatrix} 1 & 0 & 0 \\ 3 & 0 & 0 \\ 2 & 5 & 5 \end{bmatrix}$

**23.** $\begin{bmatrix} -8 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 4 & 0 \\ 0 & 0 & 0 & -5 \end{bmatrix}$

**24.** $\begin{bmatrix} 1 & 3 & -2 & 0 \\ 0 & 2 & 4 & 6 \\ 0 & 0 & -2 & 1 \\ 0 & 0 & 0 & 5 \end{bmatrix}$

**In Exercises 25–34, use the matrix capabilities of a graphing utility to find the inverse of the matrix (if it exists).**

**25.** $\begin{bmatrix} 1 & 2 & -1 \\ 3 & 7 & -10 \\ -5 & -7 & -15 \end{bmatrix}$

**26.** $\begin{bmatrix} 10 & 5 & -7 \\ -5 & 1 & 4 \\ 3 & 2 & -2 \end{bmatrix}$

**27.** $\begin{bmatrix} 1 & 1 & 2 \\ 3 & 1 & 0 \\ -2 & 0 & 3 \end{bmatrix}$

**28.** $\begin{bmatrix} 3 & 2 & 2 \\ 2 & 2 & 2 \\ -4 & 4 & 3 \end{bmatrix}$

**29.** $\begin{bmatrix} 0.1 & 0.2 & 0.3 \\ -0.3 & 0.2 & 0.2 \\ 0.5 & 0.4 & 0.4 \end{bmatrix}$

**30.** $\begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$

**31.** $\begin{bmatrix} 1 & 0 & 3 & 0 \\ 0 & 2 & 0 & 4 \\ 1 & 0 & 3 & 0 \\ 0 & 2 & 0 & 4 \end{bmatrix}$

**32.** $\begin{bmatrix} -1 & 0 & 1 & 0 \\ 0 & 2 & 0 & -1 \\ 2 & 0 & -1 & 0 \\ 0 & -1 & 0 & 1 \end{bmatrix}$

**33.** $\begin{bmatrix} 1 & -2 & -1 & -2 \\ 3 & -5 & -2 & -3 \\ 2 & -5 & -2 & -5 \\ -1 & 4 & 4 & 11 \end{bmatrix}$

**34.** $\begin{bmatrix} 4 & 8 & -7 & 14 \\ 2 & 5 & -4 & 6 \\ 0 & 2 & 1 & -7 \\ 3 & 6 & -5 & 10 \end{bmatrix}$

**35.** If $A$ is a $2 \times 2$ matrix given by

$$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

then $A$ is invertible if and only if $ad - bc \neq 0$. If $ad - bc \neq 0$, verify that the inverse is given by

$$A^{-1} = \frac{1}{ad - bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}.$$

**36.** Use the result of Exercise 35 to find the inverse of each matrix.

(a) $\begin{bmatrix} 5 & -2 \\ 2 & 3 \end{bmatrix}$

(b) $\begin{bmatrix} 7 & 12 \\ -8 & -5 \end{bmatrix}$

**In Exercises 37–40, use an inverse matrix to solve the system of linear equations. (Use the inverse matrix found in Exercise 11.)**

**37.** $x - 2y = 5$
$2x - 3y = 10$

**38.** $x - 2y = 0$
$2x - 3y = 3$

**39.** $x - 2y = 4$
$2x - 3y = 2$

**40.** $x - 2y = 1$
$2x - 3y = -2$

**In Exercises 41 and 42, use an inverse matrix to solve the system of linear equations. (Use the inverse matrix found in Exercise 19.)**

**41.** $x + y + z = 0$
$3x + 5y + 4z = 5$
$3x + 6y + 5z = 2$

**42.** $x + y + z = -1$
$3x + 5y + 4z = 2$
$3x + 6y + 5z = 0$

**In Exercises 43 and 44, use an inverse matrix and the matrix capabilities of a graphing utility to solve the system of linear equations. (Use the inverse matrix found in Exercise 33.)**

**43.** $x_1 - 2x_2 - x_3 - 2x_4 = 0$
$3x_1 - 5x_2 - 2x_3 - 3x_4 = 1$
$2x_1 - 5x_2 - 2x_3 - 5x_4 = -1$
$-x_1 + 4x_2 + 4x_3 + 11x_4 = 2$

**44.** $x_1 - 2x_2 - x_3 - 2x_4 = 1$
$3x_1 - 5x_2 - 2x_3 - 3x_4 = -2$
$2x_1 - 5x_2 - 2x_3 - 5x_4 = 0$
$-x_1 + 4x_2 + 4x_3 + 11x_4 = -3$

**In Exercises 45–52, use an inverse matrix to solve (if possible) the system of linear equations.**

**45.** $3x + 4y = -2$
$5x + 3y = 4$

**46.** $18x + 12y = 13$
$30x + 24y = 23$

**47.** $-0.4x + 0.8y = 1.6$
$2x - 4y = 5$

**48.** $13x - 6y = 17$
$26x - 12y = 8$

**49.** $3x + 6y = 6$
$6x + 14y = 11$

**50.** $3x + 2y = 1$
$2x + 10y = 6$

**51.** $4x - y + z = -5$
$2x + 2y + 3z = 10$
$5x - 2y + 6z = 1$

**52.** $4x - 2y + 3z = -2$
$2x + 2y + 5z = 16$
$8x - 5y - 2z = 4$