

3-8B Skills Practice

Solving Systems of Equations Using Inverse Matrices and Calculators

Use a matrix equation and your calculator to solve each system of equations.

① $p - 3q = 6$
 $2p + 3q = -6$

$$\begin{bmatrix} 1 & -3 \\ 2 & 3 \end{bmatrix} \cdot \begin{bmatrix} p \\ q \end{bmatrix} = \begin{bmatrix} 6 \\ -6 \end{bmatrix}$$

$A \cdot X = B$

$$X = A^{-1} \cdot B = \begin{bmatrix} 0 \\ -2 \end{bmatrix} \rightarrow (0, -2)$$

② $-x - 3y = 2$
 $-4x - 5y = 1$

$$\begin{bmatrix} -1 & -3 \\ -4 & -5 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$$

$A \cdot X = B$

$$X = A^{-1} \cdot B = \begin{bmatrix} 1 \\ -1 \end{bmatrix} \rightarrow (1, -1)$$

③ $2m + 2n = -8$
 $6m + 4n = -18$

$$\begin{bmatrix} 2 & 2 \\ 6 & 4 \end{bmatrix} \cdot \begin{bmatrix} m \\ n \end{bmatrix} = \begin{bmatrix} -8 \\ -18 \end{bmatrix}$$

$$A \cdot X = B$$

$$X = A^{-1} \cdot B = \begin{bmatrix} -1 \\ -3 \end{bmatrix} \rightarrow (-1, -3)$$

④ $-3a + b = -9$
 $5a - 2b = 14$

$$\begin{bmatrix} -3 & 1 \\ 5 & -2 \end{bmatrix} \cdot \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} -9 \\ 14 \end{bmatrix}$$

$A \cdot X = B$

$$X = A^{-1} \cdot B = \begin{bmatrix} 4 \\ 3 \end{bmatrix} \rightarrow (4, 3)$$

Mr. Smith's art class took a bus trip to an art museum. The bus averaged 65 mph on the highway and 25 mph in the city. The museum is 375 miles away from the school, and it took the class 7 hours to get there. How many hours does the bus spend driving on the highway and how many hours does the bus spend driving in the city?

a) Define your variables. Write a system that represents the situation.

$$\begin{aligned} 65x + 25y &= 375 \\ x + y &= 7 \end{aligned}$$

$x = \#$ of hrs on highway
 $y = \#$ of hrs on city roads

b) Write the matrix equation for the system AND then use your calculator to solve.

$$\begin{bmatrix} 65 & 25 \\ 1 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 375 \\ 7 \end{bmatrix}$$

$A \cdot X = B$

$$X = A^{-1} \cdot B = \begin{bmatrix} 5 \\ 2 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix}$$

c) Interpret the results.

The bus drove 5 hrs on the highway & 2 hrs in the city to get to the museum

At the arcade Sam won 2 blue tickets, 1 yellow & 3 red for 1500 total pts.
 Jamal won blue tickets, 1 yellow ticket and 3 red tickets for 1500 total points. Jamal won 1
 blue ticket, 2 yellow tickets, and 2 red tickets for 1225 total points. Yvonne won 2 blue tickets, 3 yellow tickets
 and 1 red ticket for 1200 total points. Write and solve a system of equations to determine the point value of
 each type of ticket.

a) Define your variables. Write a system that represents the situation.

$$\begin{aligned} 2b + y + 3r &= 1500 \\ b + 2y + 2r &= 1225 \\ 2b + 3y + 1r &= 1200 \end{aligned}$$

$$\begin{aligned} b &= \text{pt value of a blue ticket} \\ y &= \text{ " " " " yellow ticket} \\ r &= \text{ " " " " red ticket} \end{aligned}$$

b) Write the matrix equation for the system AND then use your calculator to solve.

$$\begin{bmatrix} 2 & 1 & 3 \\ 1 & 2 & 2 \\ 2 & 3 & 1 \end{bmatrix} \cdot \begin{bmatrix} b \\ y \\ r \end{bmatrix} = \begin{bmatrix} 1500 \\ 1225 \\ 1200 \end{bmatrix} \quad X = A^{-1} \cdot B = \begin{bmatrix} 125 \\ 200 \\ 350 \end{bmatrix}$$

$A \cdot X = B$

c) Interpret the results.

blue tickets are worth 125 pts.
 yellow " " " 200 "
 red " " " 350 "