

Chapter 9 / **Example 5****Solving equations with matrices**

Solve the systems of equations by first forming a matrix equation.

$$\text{a} \quad \begin{cases} 10x - 5y = 35 \\ -3x + 7y = 23 \end{cases} \quad \text{b} \quad \begin{cases} 4s - 3t - 2z = 0 \\ 2s + 2t + 3z = -6 \\ 6s + t - z = 2 \end{cases}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 10 & -5 \\ -3 & 7 \end{pmatrix}^{-1} \begin{pmatrix} 35 \\ 23 \end{pmatrix}$$

Press $\boxed{2\text{nd}} \boxed{[x^{-1}]} \boxed{[\text{MATRX}]} \blacktriangleright \blacktriangleright$ EDIT 1:[A] and press $\boxed{\text{ENTER}}$.

NAMES MATH **EDIT**
 1:[A]
 2:[B]
 3:[C]
 4:[D]
 5:[E]
 6:[F]
 7:[G]
 8:[H]
 9↓[I]

Change the dimensions of the matrix to 2×2 and press $\boxed{\text{ENTER}}$.

MATRIX[A] 2 × 2
 $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$
 [A](1,1)= 0

Enter the values of the elements of the 2×2 matrix, using $\boxed{\text{ENTER}}$ to move through the matrix.

MATRIX[A] 2 × 2
 $\begin{bmatrix} 10 & -5 \\ -3 & 7 \end{bmatrix}$
 [A](2,2)= 7

Press $\boxed{2\text{nd}} \boxed{[x^{-1}]} \boxed{[\text{MATRX}]} \blacktriangleright \blacktriangleright$ EDIT 2:[B] and press $\boxed{\text{ENTER}}$.

NAMES MATH **EDIT**
 1:[A] 2×2
 2:[B]
 3:[C]
 4:[D]
 5:[E]
 6:[F]
 7:[G]
 8:[H]
 9↓[I]

Change the dimensions of the matrix to 2×1 and press $\boxed{\text{ENTER}}$.

MATRIX[B] 2 × 1
 $\begin{bmatrix} 0 \\ 0 \end{bmatrix}$
 [B](1,1)= 0

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Enter the values of the elements of the 2×1 matrix, using **ENTER** to move through the matrix.

MATRIX[B] 2 \times 1
 $\begin{bmatrix} 35 \\ 23 \end{bmatrix}$
 [B](2,1)= 23

Press **2nd** **MODE** **[QUIT]**.

Press **2nd** **x^{-1}** **[MATRX]** 1:[A] and press **ENTER**.

Press **x^{-1}** and press **\times** .

Press **2nd** **x^{-1}** **[MATRX]** 2:[B] and press **ENTER**.

[A]⁻¹*[B]
 $\begin{bmatrix} 6.545454545 \\ 6.090909091 \end{bmatrix}$

Press **[ALPHA]** **[F1]** 4:►F◀D and press **ENTER**.

The GDC displays the result in fractional form.

$$x = \frac{72}{11} \text{ and } y = \frac{67}{11}.$$

[A]⁻¹*[B]
 $\begin{bmatrix} 6.545454545 \\ 6.090909091 \end{bmatrix}$
 Ans►F◀D
 $\begin{bmatrix} \frac{72}{11} \\ \frac{67}{11} \end{bmatrix}$

$$\begin{pmatrix} s \\ t \\ z \end{pmatrix} = \begin{pmatrix} 4 & -3 & -2 \\ 2 & 2 & 3 \\ 6 & 1 & -1 \end{pmatrix}^{-1} \begin{pmatrix} 0 \\ -6 \\ 2 \end{pmatrix}$$

Press **2nd** **x^{-1}** **[MATRX]** ►► EDIT 3:[C] and press **ENTER**.

NAMES MATH **EDIT**
 1:[A] 2 \times 2
 2:[B] 2 \times 1
 3:[C]
 4:[D]
 5:[E]
 6:[F]
 7:[G]
 8:[H]
 9↓[I]

Change the dimensions of the matrix to 3×3 and press **ENTER**.

MATRIX[C] 3 \times 3
 $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$
 [C](1,1)= 0

Enter the values of the elements of the 3×3 matrix, using **ENTER** to move through the matrix.

MATRIX[C] 3 \times 3
 $\begin{bmatrix} 4 & -3 & -2 \\ 2 & 2 & 3 \\ 6 & 1 & -1 \end{bmatrix}$
 [C](3,3)= -1

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Press $\boxed{2\text{nd}} \boxed{x^{-1}} \boxed{\text{MATRX}} \blacktriangleright \blacktriangleright$ EDIT 4:[D] and press $\boxed{\text{ENTER}}$.

NAMES MATH **EDIT**
 1:[A] 2×2
 2:[B] 2×1
 3:[C] 3×3
 4:[D]
 5:[E]
 6:[F]
 7:[G]
 8:[H]
 9↓[I]

Change the dimensions of the matrix to 3×1 and press $\boxed{\text{ENTER}}$.

MATRIX[D] 3 × 1
 $\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

Enter the values of the elements of the 3×1 matrix, using $\boxed{\text{ENTER}}$ to move through the matrix.

MATRIX[D] 3 × 1
 $\begin{bmatrix} 0 \\ -6 \\ 2 \end{bmatrix}$

Press $\boxed{2\text{nd}} \boxed{\text{MODE}} \boxed{\text{QUIT}}$.

Press $\boxed{2\text{nd}} \boxed{x^{-1}} \boxed{\text{MATRX}} \blacktriangleright$ 3:[C] and press $\boxed{\text{ENTER}}$.

Press $\boxed{x^{-1}}$ and press $\boxed{\times}$.

Press $\boxed{2\text{nd}} \boxed{x^{-1}} \boxed{\text{MATRX}} \blacktriangleright$ 4:[D] and press $\boxed{\text{ENTER}}$.

Ans \blacktriangleright F \blacktriangleleft D
 $\begin{bmatrix} 72 \\ 11 \\ 67 \\ 11 \end{bmatrix}$

 $[C]^{-1} * [D]$
 $\begin{bmatrix} -.3333333333 \\ 1.333333333 \\ -2.666666667 \end{bmatrix}$

Press $\boxed{\text{ALPHA}} \boxed{\text{F1}} \blacktriangleright$ 4: \blacktriangleright F \blacktriangleleft D and press $\boxed{\text{ENTER}}$.

The GDC displays the result in fractional form.

$$s = -\frac{1}{3}, t = \frac{4}{3} \text{ and } z = -\frac{8}{3}.$$

$\begin{bmatrix} -.3333333333 \\ 1.333333333 \\ -2.666666667 \end{bmatrix}$
 Ans \blacktriangleright F \blacktriangleleft D
 $\begin{bmatrix} 1 \\ 3 \\ 3 \\ 8 \\ 3 \end{bmatrix}$