

Math: Precalculus

Basic Matrix Algebra

Objectives

Students will be able to:

- Use a matrix to solve a system of linear equations.
-

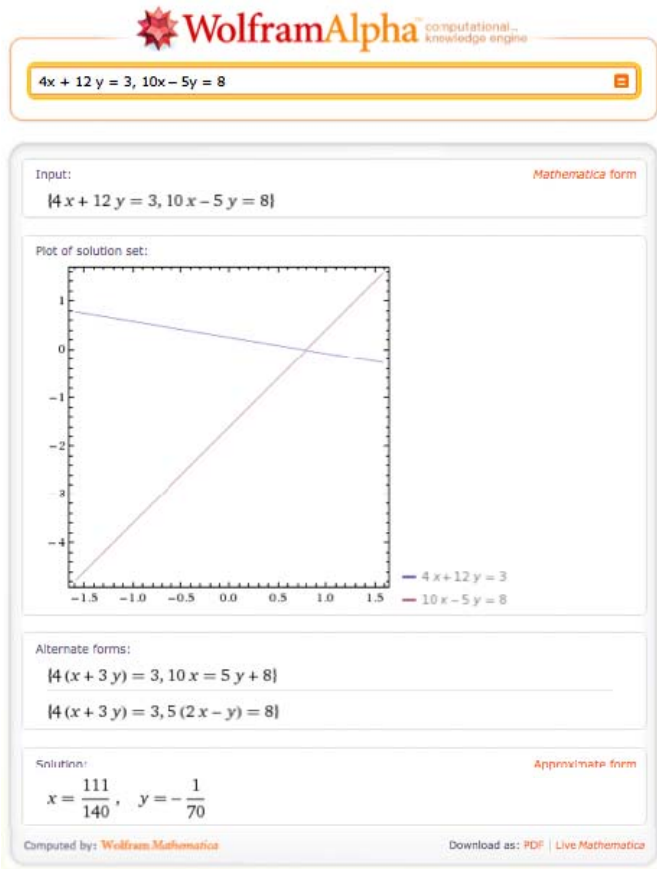
Warm-Up

Give students the system of equations:

$$4x + 12y = 3$$

$$10x - 5y = 8$$

Ask them to find a solution satisfying both equations. Check the answer with W|A.



Lesson

- Your students probably went about solving the system of equations through algebraic methods commonly known as combination or substitution. Explain how to solve the equation differently, beginning by making the coefficients of the equations into the elements of a matrix with x coefficients in the first column, y coefficients in the second column, and the constant terms in the third column.

$$\begin{pmatrix} 4 & 12 & 3 \\ 10 & -5 & 8 \end{pmatrix}$$

- Now show students how to solve for x and y by combining the top and bottom rows through addition, subtraction, and scalar multiplication until the x and y coefficients are reduced to the rows 1, 0 and 0, 1. This process is known as finding the reduced row form of the matrix.


 $\{10, -5, 8\} - 2\{4, 12, 3\}$

Input:

 $\{10, -5, 8\} - 2\{4, 12, 3\}$

Mathematica form

Result:

 $\{2, -29, 2\}$
Computed by: [Wolfram Mathematica](#)Download as: [PDF](#) | [Live Mathematica](#)
 $\{4, 12, 3\} - 2\{2, -29, 2\}$

Input:

 $\{4, 12, 3\} - 2\{2, -29, 2\}$

Mathematica form

Result:

 $\{0, 70, -1\}$
Computed by: [Wolfram Mathematica](#)Download as: [PDF](#) | [Live Mathematica](#)
 $\{0, 70, -1\}/70$

Input:

 $\frac{1}{70}\{0, 70, -1\}$

Mathematica form

Result:

 $\left\{0, 1, -\frac{1}{70}\right\}$

Approximate form

Computed by: [Wolfram Mathematica](#)Download as: [PDF](#) | [Live Mathematica](#)
 $\{2, -29, 2\} + 29\left\{0, 1, -\frac{1}{70}\right\}$

Input:

 $\{2, -29, 2\} + 29\left\{0, 1, -\frac{1}{70}\right\}$

Mathematica form

Result:

 $\left\{2, 0, \frac{111}{70}\right\}$

Approximate form

Computed by: [Wolfram Mathematica](#)Download as: [PDF](#) | [Live Mathematica](#)

WolframAlpha computational knowledge engine

Input: $\frac{1}{2} \left\{ 2, 0, \frac{111}{70} \right\}$ Mathematica form

Result: $\left\{ 1, 0, \frac{111}{140} \right\}$ Approximate form

Computed by: Wolfram|Mathematica Download as: PDF | Live Mathematics

- The final reduced row form for this matrix is

WolframAlpha computational knowledge engine

Input: $\begin{pmatrix} 1 & 0 & \frac{111}{140} \\ 0 & 1 & -\frac{1}{70} \end{pmatrix}$ Mathematica form

Dimensions: 2 (rows) \times 3 (columns)

Matrix plot:

	1	2	3
1			
2			
	1	2	3

Computed by: Wolfram|Mathematica Download as: PDF | Live Mathematics

corresponding to the solution $x = 111/140$, $y = -1/70$.

Closing

- Give students different pairs of linear equations and ask them to solve for the intersection of the two lines by finding the reduced row form of the coefficient matrix.

Demonstrations

Two-by-Two Linear Systems Problem Generator

Linear Equations: Row and Column View